THE IMPLEMENTATION OF MANUFACTURING CONCEPTS IN A NON-TRADITIONAL MANUFACTURING ENVIRONMENT

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Abstract

This thesis is the result of a two year Teaching Company Programme between Middlesex University and Tony Stone Images in which basic manufacturing philosophy has been applied to an arts based company.

Various techniques were used including flowcharts, a production simulation package and a critical path analysis to determine the production lead time of a photographic transparency to three possible destinations. On identifying the processes involved a series of smaller projects were undertaken to remove the non-value adding elements. In some cases this resulted in some quite large changes occurring in the company; one being to move departmental locations in the building to better reflect the flow of work through the organisation.

Once improvements had been made a system was installed which allows accurate tracking of the images through the processes in terms of their volume, location and routing history. This has provided valuable information on image processing by giving a more realistic figure for production lead time rather than the senior managers relying on a 'best guess' for each department. The system became known as the Workflow System and its development and installation was divided into two phases. This thesis covers phase one.

One of the most important issues arising from the project is the fact that the company has grown so rapidly over the last few years it has become unable to change culture and operating policy to meet the demands of the customer or competition. The conflict between image quality and image volume needs to be conquered in order to allow production to be more scientifically measured and controlled to provide an efficient manufacturing lead time to satisfy market needs. The Workflow System has provided the foundations upon which this measurement and control can be built.

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Acknowledgements

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My thanks and appreciation also go to Dr. Raj Gill and Dr. Mehmet Karamanoglu for their encouragement through many difficult times and who convinced me that it would be beneficial to me continuing with an academic qualification.

Finally to Mr. Brian Nuttall of the Teaching Company Directorate for his support from the side lines. Also my parents Ken and Nadine Hollands who although can no longer help me with my 'homework' are always there with endless cups of tea and sympathy and who have been a real inspiration through a difficult period in my life.

1. Introduction

This thesis is the result of work carried out over a 2 year period on a Teaching Company Scheme. Liaison took place between Tony Stone Images (the industrial partner) hereafter referred to as TSI or the company, and Middlesex University (the academic partner).

1.1 Tony Stone Images

The business was started by Tony Stone in 1962 with the idea to sell stock or 'off the shelf' photography to the greeting card, calendar and related markets. In 1969 the company was incorporated and started representing the work of other photographers. In the early 70s Tony Stone Images (TSI) moved into the advertising, design and travel markets.

Today it is involved in the production and lease of photographic transparencies to various markets.

In order to protect the transparencies whilst they are with clients, a process by which the images are mounted, captioned and security sealed takes place. The diagram in figure 1 gives an impression of the appearance of the finished product.

In 1993 the company was awarded the Queen's award for export, and in 1995 a substantial investment was made in the company by Mark Getty and Jonathan Kline, formerly of Hambros Bank. The investment has allowed expansion into untapped markets such as the Pacific Rim and to allow the modernisation of the control systems required to manage a larger organisation.

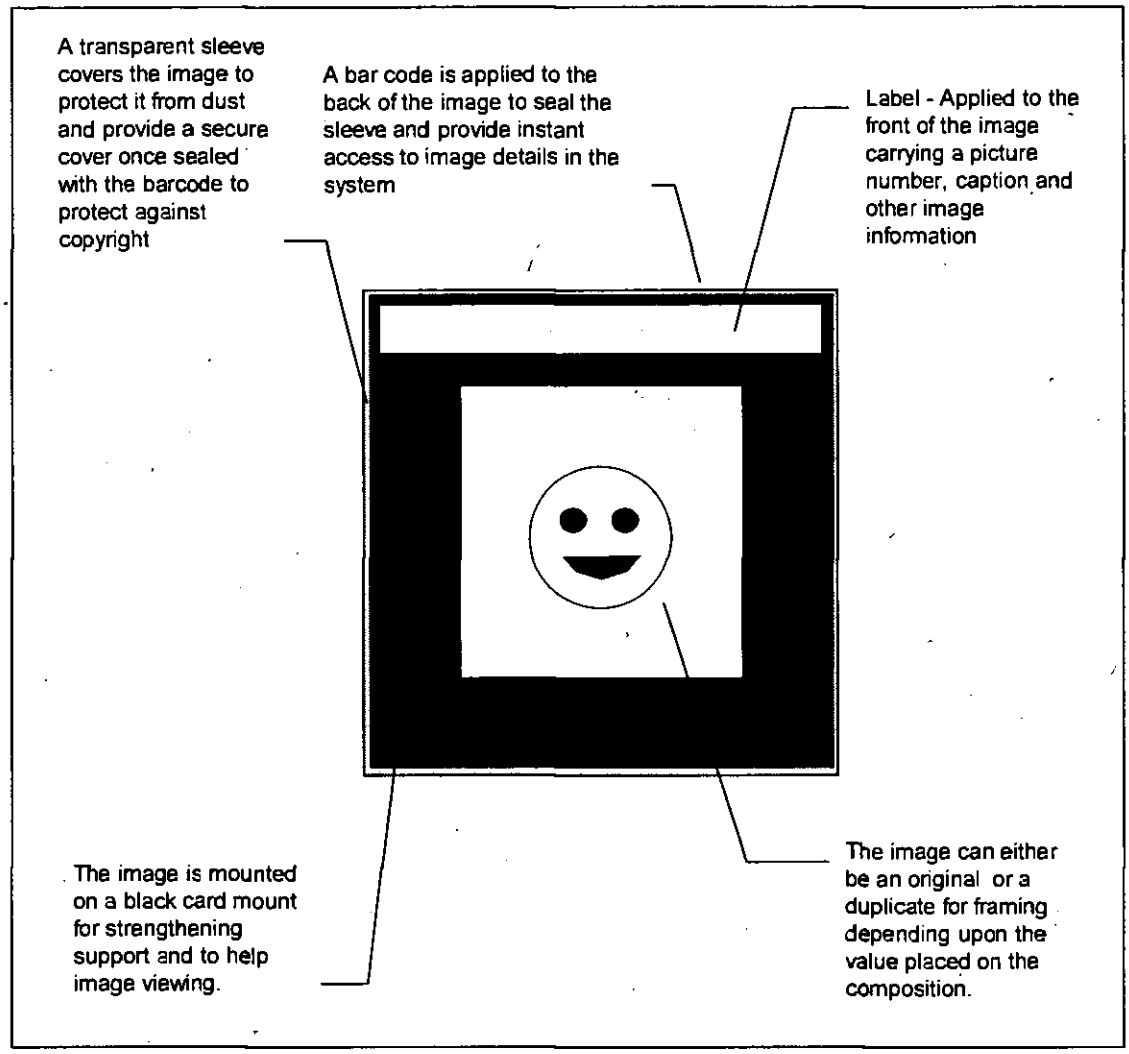

Figure 1 - Tony Stone Images product composition

Company growth can be shown by the following charts in terms of profit, turnover and number of employees.

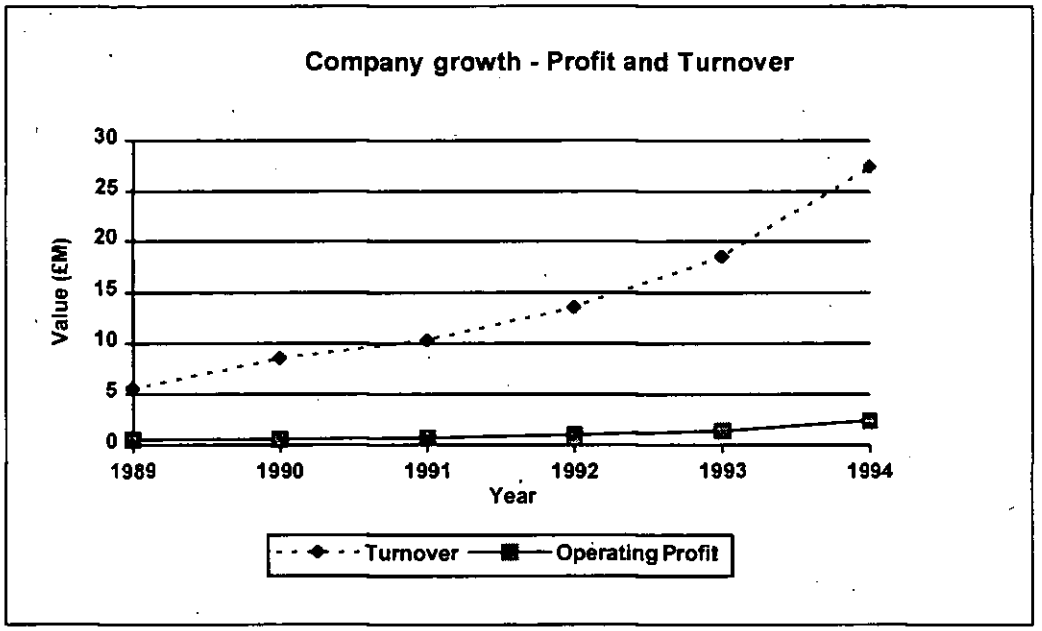

Figure 2 - Company growth in terms of turnover and operating profit

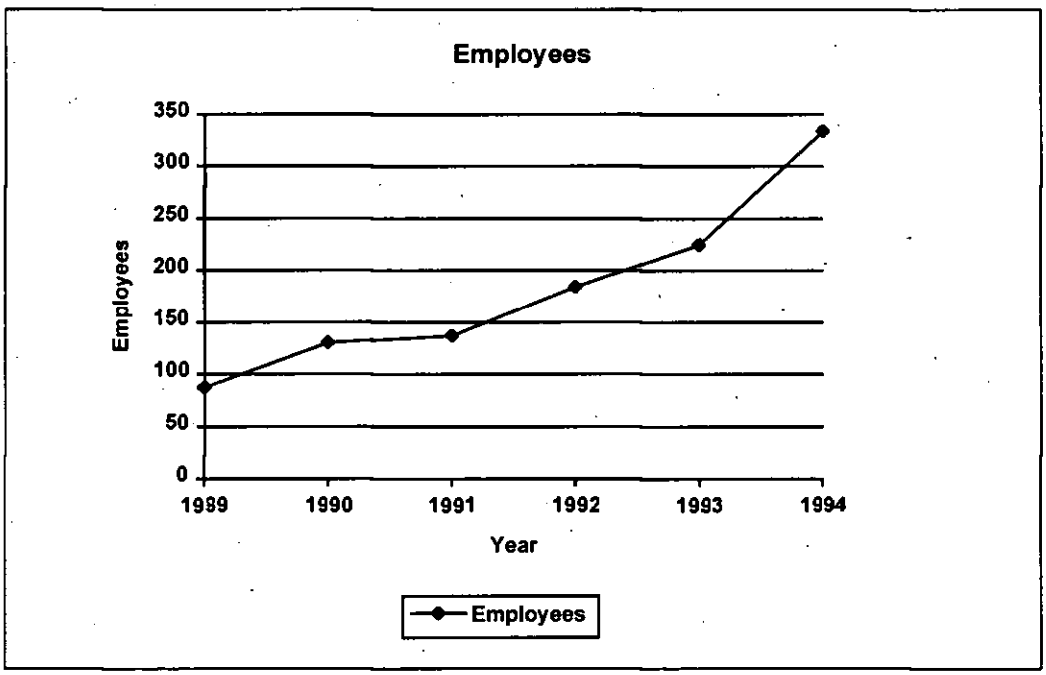

Figure 3 - Company growth in terms of number of employees

At the time of writing there were a total of 20 overseas offices and agents selling stock images. Details of their contracts and acquisition dates are shown in the following table.

Agent	Country	Acquisition Date
Photographic Library of Australia	Australia	1/12/84
World View Tony Stone	Belgium	1/3/91
World View Tony Stone	Holland	1/9/87
Pro-file International	Hong Kong	1/1/90
	Singapore	1/4/91
Laura Ronchi-Tony Stone	Italy	1/1/91
Orion Press	Japan	11/7/84
Photobank Image Library	New Zealand	30/6/87
Photo Library (Pty) Ltd	South Africa	6/9/85
Fototeca Stone International	Spain	19/7/85
Tony Stone Images / World View Sweden AB	Sweden	1/9/92
Office		
Tony Stone Images Canada	Canada	1/4/91
Fotogram Stone	France	1/1/84
Tony Stone Bilderwelten	Germany	1/4/90
Tony Stone Images Chicago	USA	1/8/88
Tony Stone Images LA	USA	1/5/90
Tony Stone Images NY	USA	1/3/93

Figure 4 - Table showing company growth by office and agent acquisition

The difference between an office and an agent is whether it is solely owned by TSI or not. An office is solely owned by TSI and will only ever sell images from that company. An agent on the other hand is contracted to sell images from TSI along with any other image library it chooses to represent.

1.2 Company Culture

TSI is a very heavily arts based company with a large percentage of the 100+ employees at the London office, coming from a graphics and photography background.

The company started as a small cottage industry within the Stone family. Bit by bit the company has grown into what it is today. Charles Handy (1), visiting professor at the London Business School has been involved in organisational development and psychology for many years. His book 'Understanding Organisations', summarises work done by Roger Harrison (2) on organisation ideologies. Handy refers to these as company cultures, giving more of a feeling of a pervasive way of life, or set of norms. Three main cultures were detailed.

1.2.1 The Power Culture.

As the spider controls his/her web from the centre, so a power culture company is controlled from the centre by a key individual who exercises power on a basis of personal influence and ability. Power cultures are intolerant of bureaucratic delays and people are judged by results, not on their position or qualifications. These organisations are fast moving and responsive to changes in the market. Their weaknesses are that they are limited in size and are too dependent on the individual at the centre.

1.2.2 The Role Culture

The culture puts value on formal titles and positions. A role culture organisation consists of departments and sections each with well defined tasks and activities, co-ordinated by a band of senior managers. These organisations are capable of in-depth technical expertise, but tend not to be too effective at innovation or cost control. They are successful in a stable environment.

1.2.3 The Task culture

The task culture can be depicted by a matrix with technical personnel working in various project orientated teams. It does not produce great technical expertise or economies of scale but it does tend to 'get the job done'. Task

cultures are responsive to changes in the market place but cannot work effectively where resources are limited.

Fitting TSI into a culture band is difficult as with growth the culture of the company has changed. The company has traits of both Power and Role cultures and can be placed on a scale as follows.

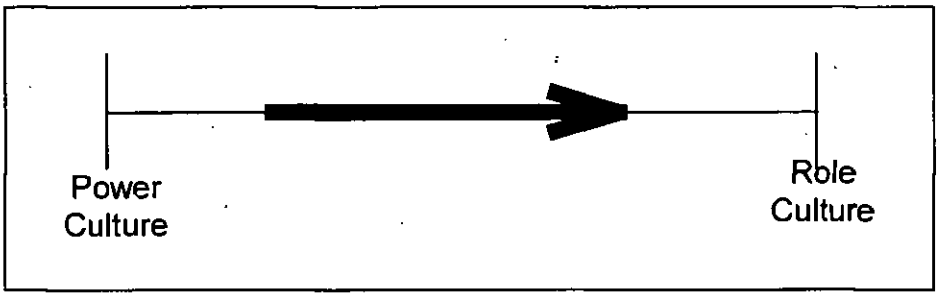

Figure 5 - The shift from power to role culture within Tony Stone Images.

When the company was small, it was lead by Tony Stone himself who had a small group of people working for him. He lead the trends in the types of images the library would hold and oversaw financial and marketing issues as well as making the final decision over the structure of the company's annual catalogue.

As time progressed and more and more images were being bought, more people were recruited and the company began to split into departments. With this came the department managers and the interdepartmental problems. Eventually the company became a role culture desperately trying to retain its power culture traits without realising it. In other words, the company was outgrowing the cosiness of a small company whilst maintaining the small company mindset.

As the departments were created, a need for control and communication arose. The company entered a period of cultural malaise.

1.2.4 Cultural Malaise

The following are symptoms of cultural malaise, with examples of the these occurring in TSI.

1.2.4.1 Inward Focus

The departments that were created by growth have become more bothered about their own needs rather than perhaps considering how their actions were affecting others.

1.2.4.2 Short Term Focus

Due to growth in both employees and production volumes, the need for 'quick fixes' are now an everyday occurrence.

Extra darkrooms have been built to enable the company to meet a budgeted increase in production of 50%. Little thought was given to the individuals who had to process the extra work.

The company outgrew previous premises and in desperation for space took the current building with a 25 year lease and expensive rent. The company has now outgrown the premises again after only four years.

1.2.4.3 Morale Problems

Again, due to growth, departments are now larger and their efforts are not always being recognised by those more senior or in other areas of the business.

People feel unable to air their problems and are not feeling appreciated, thus lacking morale and motivation.

1.2.4.4 Fragmentation

The 'them and us' attitudes have grown between subordinates and their seniors both within departments and throughout the company hierarchy.

1.2.4.5 Emotional Outbursts.

Although none are actually witnessed it is more and more apparent that the security blanket provided by the company is developing holes. The direction of the overall business seems to lack focus and individuals are becoming frightened.

This cultural malaise is becoming a barrier to possible change within TSI. The existence of departments create more barriers and the fact that images are physically created to be sold indicates that a manufacturing process, however crude or labour intensive exists.

Intervention by Middlesex University clarified some of the company's shortfalls and highlighted possible starting points for making changes which will enable the company to cope with its rapid growth.

The analogy on the next page can be used to show how it can be easier to see the problems a company is experiencing from an outside view.

The diagram is taken from a series of lecture notes called 'The Creative Consultant' by Dr. Victor Newman (20) at Cranfield University and the helicopter represents the ability to step away from the company and view the change problems as a whole. The clock indicates the time element involved which can be weeks, months or even years depending upon the changes required.

In the centre of the picture, the small circle shows the present company position and the cross shows where it wants to be, in terms of achieving the change. Between the two positions are obstacles which need to be overcome or removed.

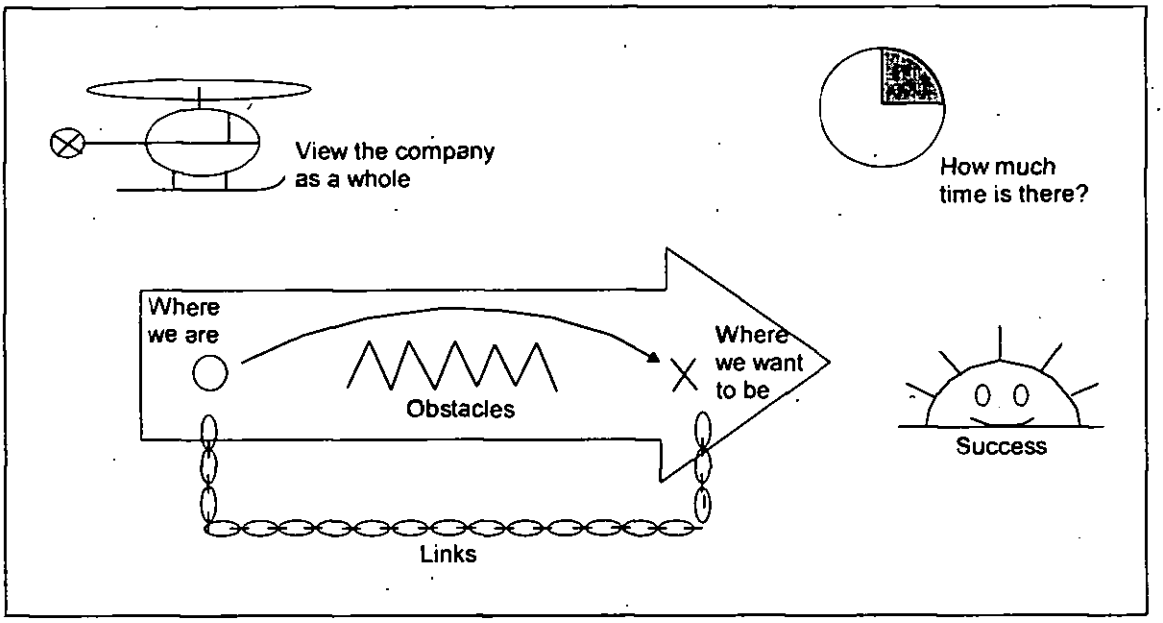

Figure 6 - The helicopter view of a change problem

In the case of TSI, the directors know where they want to be and how long they want to take to get there but are not sure whether the expertise or knowledge exists within the company to achieve the goal. Doesn't a manufacturing process require engineers?

Further work with Middlesex University has identified a requirement for knowledge which is not available within the organisation. The need for an individual to take the helicopter view and help the business move towards its goal with an appreciation for overall demands was identified.

In the early months of 1993, the wheels of the Teaching Company Scheme were put into motion and by the end of September in the same year, an Associate was working at Tony Stone Images.

1.3 The Teaching Company Scheme

The Teaching Company Scheme (TCS) is supported and financed by a number of government agencies.

The mission of the TCS is:-

"To strengthen the competitiveness and wealth creation of the UK by the stimulation of innovation in industry through partnerships between academia and business".

Within each established TCS there may be one or a number of Teaching Company Programmes (TCP) in progress.

The emphasis on industry was appealing to TSI with the anticipation of the manufacturing knowledge they lacked and needed.

Each programme is jointly funded between the industrial partner and the government sponsor. Each scheme is also allocated a Teaching Company Consultant who makes sure that the scheme is running according to plan and can act as a go-between should the associate be having any problems with the relationship between the company and the university.

The scope of the TCP to be undertaken at Tony Stone Images, of which this thesis forms only a part, was jointly funded between the government and TSI. The Teaching Company Consultant was Mr. Brian Nuttall.

The Associate spends approximately 80% of their time with the industrial partner carrying out previously agreed improvement projects and 20% with the university making use of laboratory facilities, computer facilities and the library, to aid with the industrial work.

An associate typically spends 2 years with the industrial partner after which time may seek employment with them. If the industial partner wishes for more work to be done through the scheme, the proposal is drawn up for the number of associates required to overlap by a year. For example, a scheme with 2 associates would run for three years with both associates being present in the second year.

Each programme has a written proposal covering the details of the work to be done, the personnel involved and the timescales for the completion of each stage.

The specific objectives for this TCP were:-

- To install a customised production planning and control system.
- Increase the duplication of master photographic transparencies and packaging capacity.
- Integrate the master photographic transparencies catalogue production into mainstream production.

Once the scheme is under way, it is likely that the impression of the company from the short visits by the university in setting up the proposal are different to those experienced by the associate. It is therefore important to remember that the project guidelines and objectives can be changed.

Every three months, a meeting is held between the industrial partner, the university, the associate and a teaching company consultant to assess the work which is being carried out and to make sure that there is still sense and direction to what is being done. This meeting is known as the LMC - Local Management Committee. It is at the LMC that any changes to the programme can be discussed and agreed by those present. Minutes are taken at every LMC allowing the progress of the project to be documented throughout the 2 years, including any changes to the overall objectives.

This thesis is a result of the work undertaken during the Teaching Company Programme and aims to show that many of the modern manufacturing techniques used in the analysis and improvement of production and its related functions can be applied to a non-conventional manufacturing environment, namely in this case an image library for photographic transparencies.

2. Change Management and Tony Stone Images

For TSI, the changes required to be made to the business are both cultural and physical. This can be backed up in an article written by Rosabeth Moss Kanter (3) in which she states that 'Change is indeed everywhere - regardless of country, culture or organisation'. Changes need to occur amongst the way the business processes are interpreted as well as to provide the company with the physical tools to achieve their transition between Power and Role cultures with the minimum of disruption.

2.1 How big is the change?

It is important to consider the size of the change that TSI needs to undertake . Three types of change are considered, Process Improvement; Process Redesign and Business Process Re-engineering. These are defined by John Macdonald (4) as follows.

2.1.1 Process Improvement

Total Quality Management (TQM) (5) focusses on managing an organisation so that every job and every process is carried out right first time and every time. Kaizen (6) is a continuous improvement initiative introduced by the Japanese which focusses on accepting that improvements can always be made in business and should be part of the culture rather than the big effort of step change commonly undertaken in industry. Both TQM and Kaizen put emphasis on process improvements. The organisation empowers the whole workforce to look for and implement improvements to all work processes. The improvements are often small, confined within functional boundaries and focused on improving the existing system. There is considerable impact on the work culture of the organisation where everyone in the company is involved and are orientated towards customers and processes.

2.1.2 Process Redesign

For most companies, process redesign represents radical change. Process redesign concentrates on major processes which cross functional boundaries and is generally strongly customer focused. It goes beyond improving the

existing processes and continually asks the question 'should we be doing this at all?' Process redesign is a natural evolution of Total Quality Management and uses many of the traditional techniques of Organisation and Method and Work Study. It is different through the focus on customers and the use of the opportunities available from the development of Information Technology.

2.1.3 Business Process Re-engineering

Hammer and Champy (7) have defined re-engineering as a 'fundamental rethink and radical redesign of business processes to achieve dramatic improvements in critical contemporary measures of performance, such as cost, quality, service and speed'.

The approach is based on the premise that continuous incremental improvement is not capable of meeting the challenge of the global market place. To succeed, companies need major breakthroughs in performance and to leapfrog their competitors. Rather than 10% improvements, Business Process Re-engineering expects for example to cut product development cycles by 50%, cut order delivery times from 1 month to 1 day and take 60% - 80% out of costs while at the same time improving service levels. That is dramatic change.

The following diagram taken from Macdonald's (4) book 'Understanding Business Process Reengineering in a Week'; shows the differences between improvement, redesign and re-engineering.

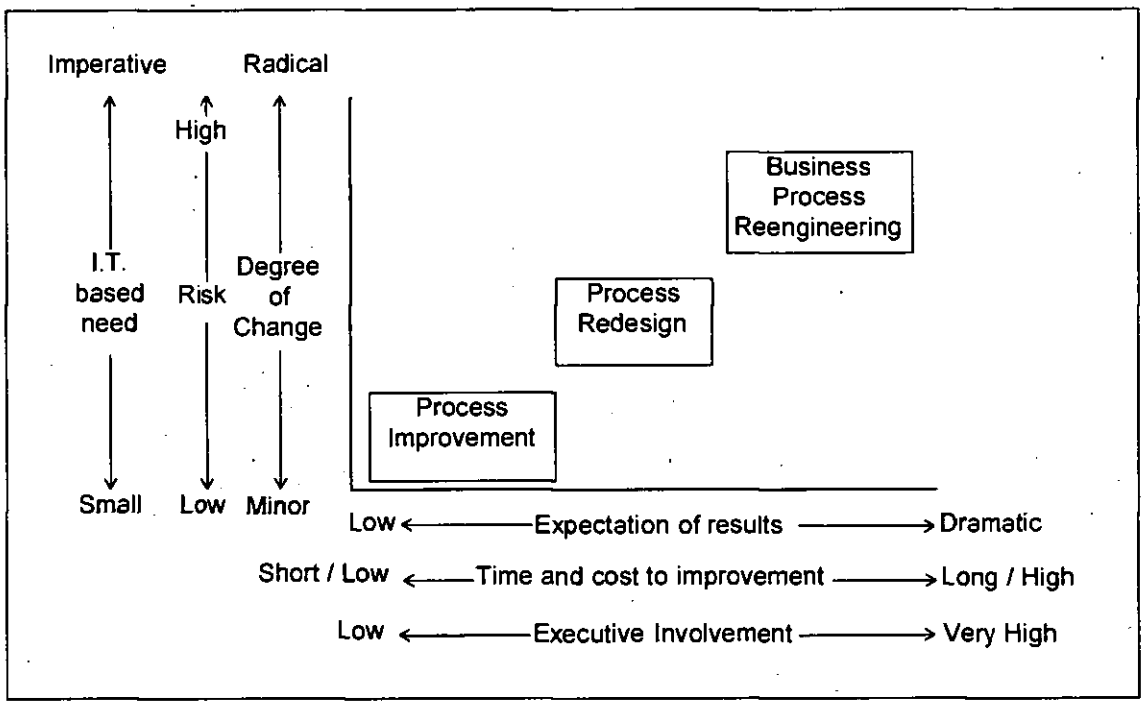

Figure 7 - Differences between improvement, redesign and engineering (MacDonald)

From the diagram and the culture of TSI as already described in Chapter 1, the method of change to be adopted by the company can be predicted. Taking each of the axis factors in turn, TSI can be placed somewhere on the chart for anticipated change methods adopted.

Expectation of results - TSI wishes to see great changes from the project, perhaps more than are physically possible. This indicates a move towards Business Process Re-engineering.

Time and Cost to Improvement - To improve in the shortest time possible and at the best and most competitive price possible is a natural reaction for any organisation. This is probably also the case with TSI, thus indicating Process Improvement.

Executive Involvement - At the beginning of the project, the executives will probably want to be involved in every detail. This being the case, Business Process Re-engineering is the way forward. It is highly likely however that once the project has been going on for a while, executive attention will be pulled

away to other strategic issues. If executive involvement cannot be maintained then there is no point in aiming for Business Process Re-engineering as a method for change. TSI probably therefore falls somewhere in the region of Process Redesign.

Degree of Change and Risk - To a large extent the company just wants to continue operating the way it is, only more efficiently. Where a manual operation is involved, it could be automated or changed in some way. At the same time, the risk factor cannot be too large as those functions to be analysed are also those which create the product to sell. The changes cannot therefore be seen as potentially damaging to the business. The degree of change and the risk involved will by no means be low, but will not be very high. The changes probably most suited to TSI indicate process redesign.

IT based need - TSI is not backwards in its awareness of the benefits of IT to the business. A new system to look after the images library and the sale of images was implemented in January 1994. The company is also of the impression that IT can significantly help production. They will not however implement IT based control for the sake of it, and any that are installed will remain as simple as possible with flexibility for the future. Again, the need for an IT base to change, places the company in the process improvement and process redesign bracket.

In summary, the factors identified by Macdonald highlight the differences between Process Improvement, Process Re-design and Business Process Re-engineering show TSI as not being particularly afraid of change but at the same time being cautious of change with respect to the effect on the business. Projects at TSI are likely to operate within the boundaries of process re-design.

2.2 Readiness and Ability to Change at Tony Stone Images

As part of some earlier work done by the author on the subject of change (8), a prototype product was developed to assess a company's readiness and ability to tackle a change programme.

The product consists of a series of questionnaires, the answers of which are plotted on a polar chart resulting in the company's changeability 'fingerprint' being identified. Areas which need improvement to facilitate the success of a change programme are highlighted. Each 'spoke' on the polar chart represents a dimension of change for the company. The chart for TSI was plotted as follows.

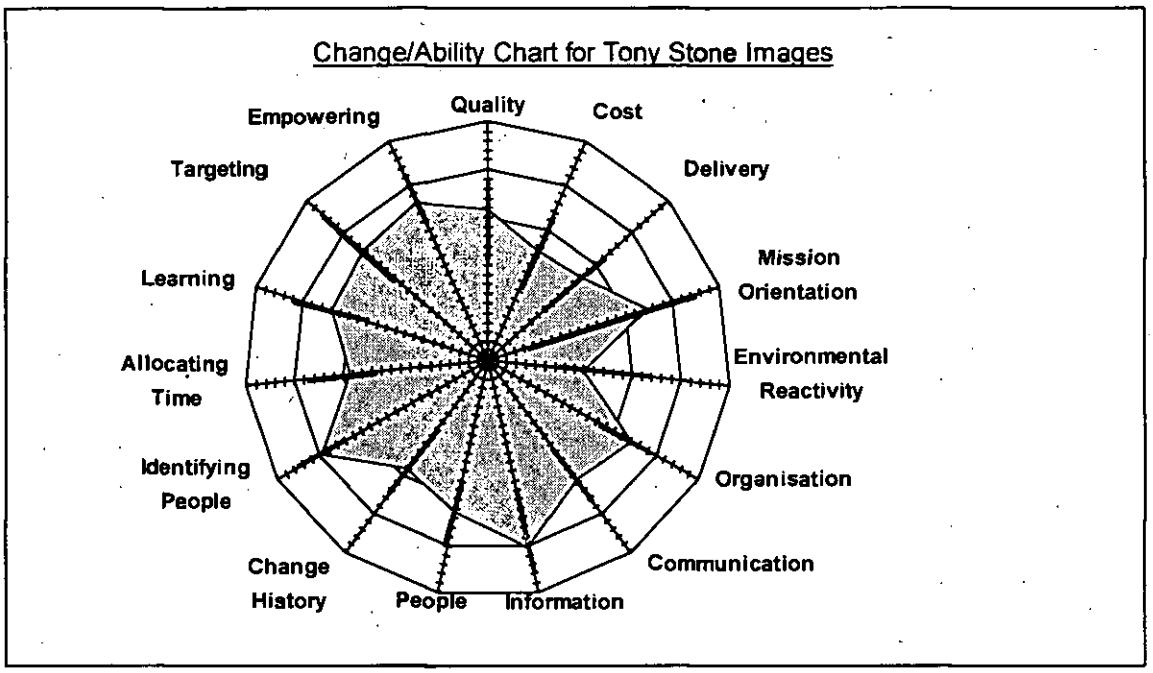

Figure 8 - The Change/Ability chart for Tony Stone Images

A week was spent at the company in August 1993 (prior to the beginning of the TCP) and during that period, 33 people from different departments within the company were involved in completing the questionnaires and then commenting on them in a 20 minute interview conducted later in the week. As the product being tested is a prototype, the results were compared to general observations made whilst at the company. A summary of the strengths, weaknesses and uncertainties of TSI in terms of the company's readiness and ability to change are as follows.

Strengths

- The company has overall success in the use of resources and groups working together towards a common purpose.
- Any information circulated around the company tends to be correct and according to that which was originally requested.
- People and their potential tends to be well recognised - good motivation. This was at least the case when the company was smaller. It may now be under question.

Weaknesses

- Although the company has a mission it is either not well defined or is poorly communicated amongst the lower levels of the company.
- The company does have a history of change programmes and they have been successful. The main concern is that the breadth and depth of the company affected by the changes are small in comparison to the levels of change expected and experienced by Teaching Company Schemes.
- Time tends to be used well for the physical activities during the course of a project however the documentation and procedural aspects scored rather weakly.

Uncertainties

- Communications achieved a low score with a wide spread of answers. This indicates that there are members of the company who communicate well with others in the organisation. There are also those who do not. Communication is always a difficult issue to overcome and may cause some problems within the course of various projects which are tackled.

- Although the ability of individuals is generally recognised, there tends to be some weakness shown in the ability to select the right people for projects in particular senior managers and key players. This supports the previous section over the involvement of senior executives in the project. It appears that they are not heavily involved in projects because they ask not to be due

to strategic issues at hand. This being the case, the selection of other key players in projects is of greater importance for the changes to be a success.

Having a mix of good communications and the right people is key to the success of any project. It may well be that TSI tackles too many projects at any one time. Some will fall by the wayside and others will be completed with varying degrees of success. Projects require people to make them work. If there are too many projects there may not be enough people to go round. This being the case, it is only right that the company considers Process Improvement or Process Redesign and not the full commitment demanded for Business Process Re-engineering to be a success.

In order to ensure as much success from the Teaching Company Programme as possible, two actions need to be taken.

1. Production needs to be recognised as a function, overseeing the manufacturing process within Tony Stone Images to highlight possible areas for improvement.
2. There also needs to be a forum set up whereby improvement projects can be discussed both at a shop floor and executive level.

In an article concerning the topic of continuous improvement, Philip Hanson (9) mentions that a Japanese manager commented that in the west, the Japanese word 'Kaizen' is used simply to mean continuous improvement. In reality it has strong connotations of sharing.

The concept of setting up improvement groups needs to be not only as a forum for airing and solving problems but also as a forum for knowledge transfer. Sharing the improvement with those in other departments and carrying out training if necessary is an ideal way to continue the work of one department through to others.

Hanson goes on to explain that the fact that the Japanese have now pioneered a new initiative known as TPM Total Productive Management which shows the necessity for continuous improvement. While lean production talks of waste elimination and the removal of non value adding activities, TPM is focused on the complete elimination (not reduction) of major losses. The TPM goal is invariably zero defects, zero downtime and zero accidents or surprises. These ambitious goals are achieved through capturing the energies and skills of the shop floor coupled with production and process engineers.

If TSI can go some way down the path of achieving these ideals, forums for discussing and achieving improvement and change can be created and used to great advantage.

2.3 Process Improvement Structures.

In an article covering manufacturing control systems depending upon the type of business being analysed, J. Browne (10) shows the following as a typical manufacturing control system hierarchy.

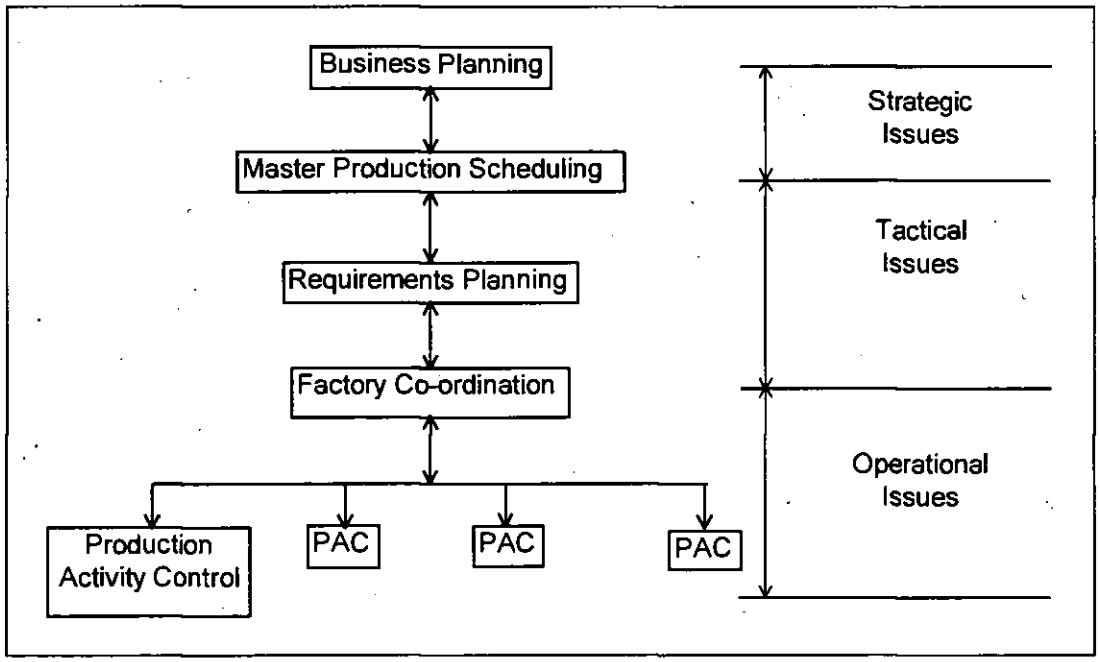

Figure 9 - Manufacturing Control systems hierarchy

When the project at TSI first began, all of the executives wanted to be involved in every activity. There was great interest in the work that was being done as for

the first time an individual was dedicated to helping the company move from O to X (see figure 6) as smoothly and with as much success as possible. This was all very well for a short time, however strategic issues soon took over and the executives did not have the time to be dealing with day to day operational issues (see 2.1.3 'Executive Involvement).

The fact that the executive felt this way can be reinforced by Browne's diagram (fig 9) which shows that the executive need to concentrate more on the strategic and tactical issues. The area where the improvements are taking place is with factory co-ordination and production activity control which are grouped under operational issues. It is right therefore that the executive should not be involved however they do need to be kept informed on a regular basis. To facilitate communication regarding project progress, and to ensure success from the TCP, two meeting forums were set up as follows:-

2.3.1 The Process Improvement Group (PIG)

PIG meetings were held weekly and involved all those who supervised at a shop floor level within the production and supporting processes.

The group's purpose was to identify improvements which could be made and find ways of tackling the obstacles such that change could take place. This often involved trial periods of the new ideas with reviews at a later date. Improvements covered by the PIG group are detailed in chapter 4. This meeting also provided a forum for those worried about senior management to air their grievances in a relaxed and supportive environment.

2.3.2 The Production Management Group (PMG)

This group also involved members of the PIG meetings with the addition of the senior executives. The meetings were held monthly and an update on the progress of the PIG was given.

The meeting also provided a forum for any issues which the PIG felt were too high level for them to tackle to be raised. This often involved ideas for

improvement which could affect company policy or which may have too much of an impact on the growth progress of the company in the long term.

Once the issues had been discussed, the PIG may or may not have been charged with the authority to carry out the change.The PMG emerged as a means for improvement issues to be passed up as well as down the managerial structure.

The following diagram shows a generalised company hierarchy to aid the understanding of those members of staff who attended PIG meetings and those who attended PMG meetings.

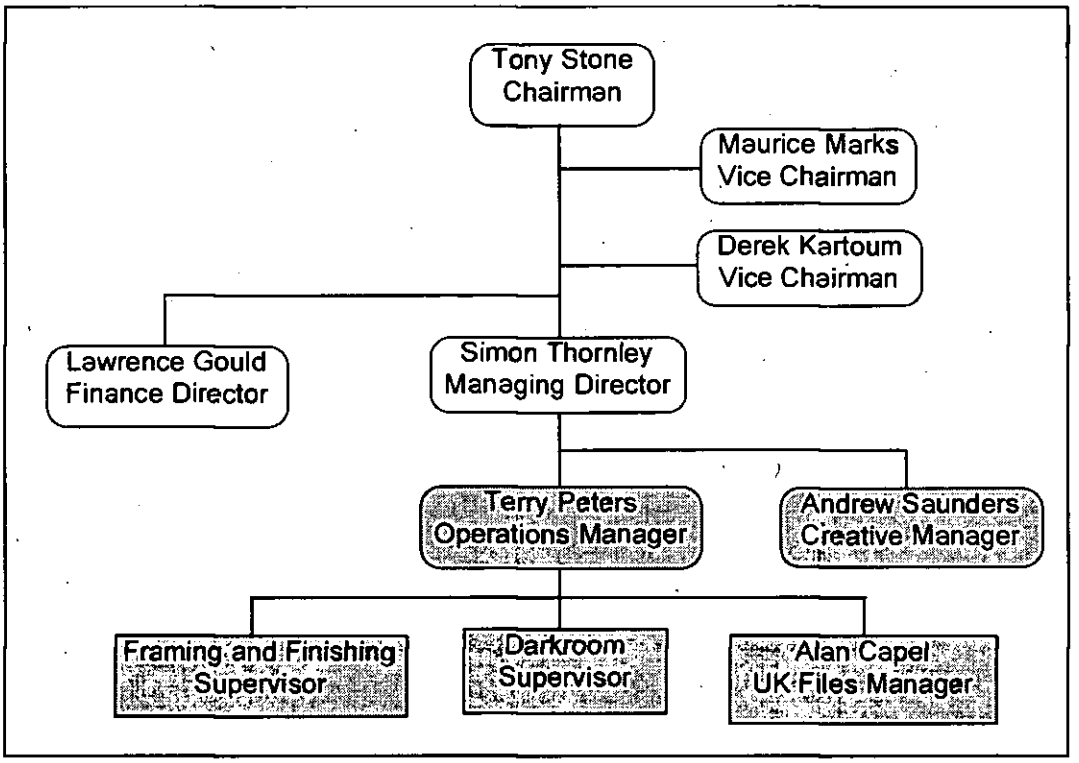

Figure 10 - Organisation Chart showing attendance to the PIG and PMG meetings (October 1993 - October 1994)

Those shown in grey attended PIG meetings whilst those with rounded boxes attended PMG meetings.

In October 1994 TSI recruited a Production Manager to oversee the controls of the manufacturing process. Lines of communication changed through the Production Manager and the PIG and PMG meetings ceased to be held. They

did however provide a good base upon which the Production Manager could build a production oriented and customer driven mindset, and were valuable in providing direction prior to the Production Manager's position being filled.

3. The Production Process

Now that the culture of TSI has been established, and the size of the changes anticipated, the production process needs to be analysed and understood in greater detail. This has been done by identifying the departments through which work flows and questioning the flow in terms of its efficiency.

3.1 Departmental Structure

3.1.1 Creative

This department looks after all of the company's associated photographers by guiding them through whatever work is required at the time and by editing any work which has been submitted for consideration as part of the collection. Creative are also responsible for working with marketing by keeping tabs on the current trends in imagery and for recruiting new photographers.

3.1.2 Image Classification

Image Classification are responsible for entering any new accepted images onto the system so that records are available. This involves adding captions, picture numbers and other details about the images which make them saleable and interesting.

3.1.3 Electronic Imaging

This department is responsible for scanning the film copy of an image into the computer server and enhancing it electronically. This involves removing logos from vehicles and clothing and generally changing the colour and appearance of an image, again to enhance saleability.

3.1.4 Darkrooms

This department essentially takes one copy of an image and duplicates it to as many times as is required. The duping quantity tends to be determined by the type of image and the international circulation it will receive. The darkroom cameras can also deal with less difficult colour enhancements and changes which would otherwise overload Electronic Imaging.

3.1.5 Framing and Finishing

This is where a batch of duplicated images are finished and distributed amongst the overseas offices and agents. The department has such a large volume of work that it uses outworkers to provide the capacity to meet demand.

3.1.6 Picture Control

As the name suggests, this department controls the movement of images outside the London office in terms of selections being sent to clients and the new images being sent to the overseas offices and agents.

3.1.7 Picture Research

This department searches for selections of images covering the required subject area to send to clients. The searches have to give a good representation of the requested area as it is from the selections that sales are made.

The other functions; Sales, marketing, accounts, despatch and systems are common to most organisations and do not really have any direct impact on the production process.

3.2 The Production Flow

Having established the departmental functions within TSI, the flow of work through production has been identified as follows:

1. Market research is carried out both externally and internally from sales records about the type of image currently in demand by various clients. This information is then fed to the Creative department who target the Associated Photographers to shoot the required images.

2. A photographer submits a selection of wok to the company (either on speculation or as targeted by Creative). The Creative department then edits the work against quality, subject and style criteria. It is then marked in terms of those images which are to be rejected and those which are good enough

to become part of the library collection. Of those which are kept, one of two paths can be taken.

The first path is that the picture is of acceptable standard to be part of the collection but does not warrant multiple copies being made - it is therefore filed as an 'original'.

The second path is where a picture is of acceptable standard to be part of the collection. It is deemed to be capable of multiple sales around the world so is put forward for duplication (of up to 300 times) - it is therefore progressed as a 'dupe possible'.

3. Rejected images are returned to the photographer. Both the originals and the dupe possibles go through the Image Classification department where they are serial numbered and have descriptive captions added.

   A second decision making process takes place at Dupe Selection, where the path for dupe possibles is determined. If an image requires enhancement then it will go through Electronic Imaging before going to the Darkrooms for duplication. If an image requires small changes such that the cameras can deal with, it goes directly to the darkrooms for duplication.

4. After duplication, the film has to go off-site for processing and on return it is quality checked. The strips of processed film go through the Framing and Finishing department. Outworkers are employed (so again work is processed off site) to mount, frame, sleeve and attach a bar-code and picture label to each individual image.

5. On returning from the outworkers, the duplicate images are divided into their countries of destination for the overseas offices and agents, are packaged up with the correct paperwork and despatched. A quota of duplicate images also remain in London for sale in the UK.

The process description is supported by the figure 11. The diagram however does not show the identification of an image need by the marketing department.

In 1995, the UK collection was holding approximately 250,000 different images (26,000 duped, 224,000 originals) and was being added to at the rate of 200 per week. On a world-wide scale, the number of originals held was approximately 2 million.

TSI also produces two catalogues per year with the policy that every image appearing in the catalogues will be available for sale in each of the offices and agents at the time of catalogue launch. This in itself creates a massive duplication programme, regardless of continuing to duplicate those images that were not selected for the catalogues.

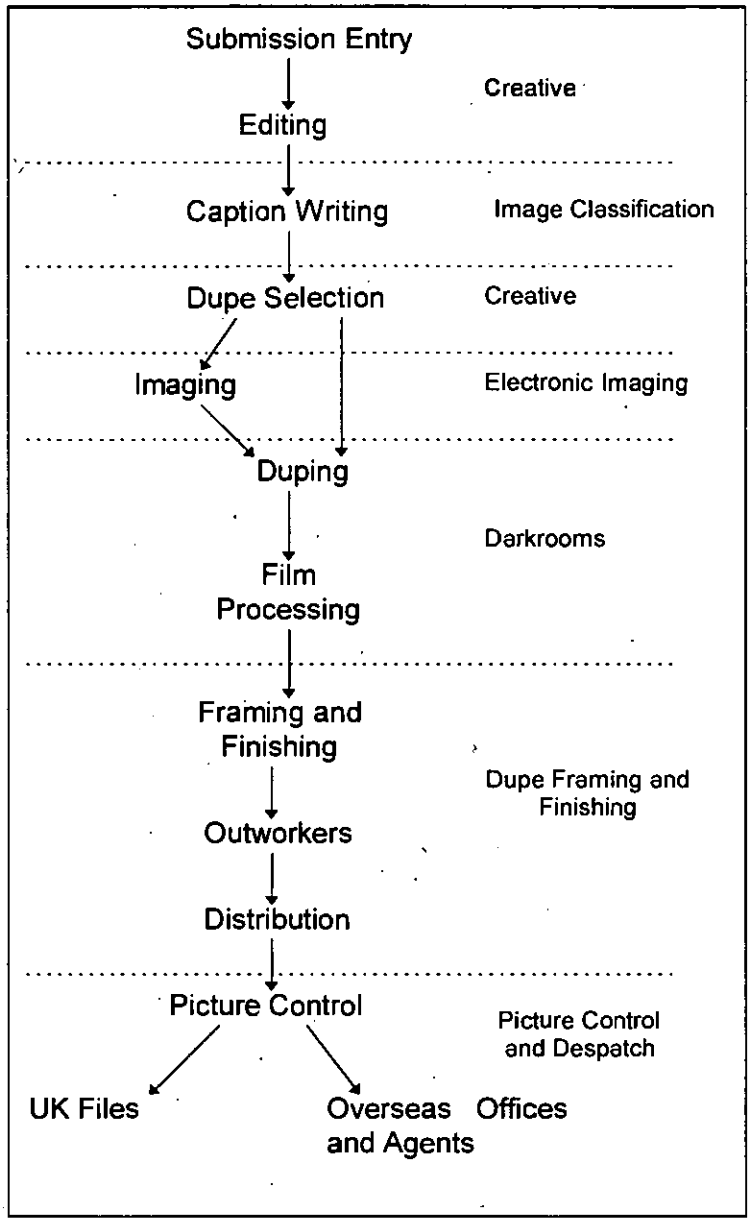

Figure 11 - Flowchart of the production process at Tony Stone Images

3.3 Establishing Product Lead Time

In order to achieve the overall goal of the TCP objectives, the product lead time needed to be established as a benchmark to begin identifying areas where improvements could be made. One issue which became immediately apparent was the logistics in moving work around the building, between floors and in and out of the building where external processes are involved. The original structure of the production process around the offices at Bayham Street from September 1993 to Spring 1994 is shown in figure 12.

Otto Von Malaise (11) explained that in order to take advantage of the whole productivity potential the entire line from the material supplier to customer delivery of the finished product must be optimised. Applied to TSI, the material supplier is the photographer, submitting images to the collection and the delivery of the finished product is two fold, one to the direct customer from London and two to the overseas offices and agents.

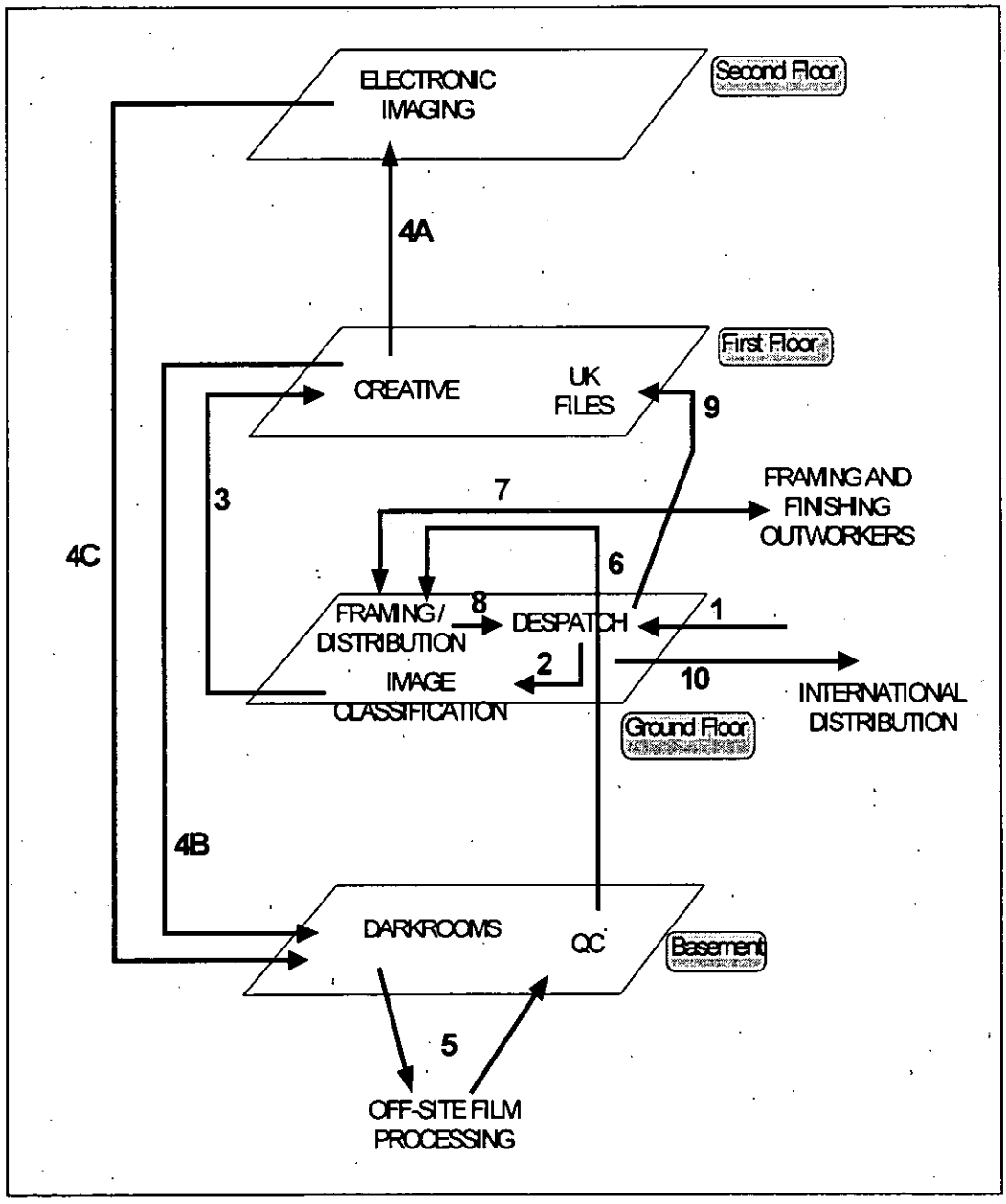

Figure 12 - Diagram showing the movement of images around the building

Early in the TCP three methods were used to understand the constraints within the production process and to establish the average product lead time. These were

- A flowchart of the whole process as detailed in section 3.2.
- Job tracking forms.
- Production Simulation Software.

Through discussion with individuals in the management structure, it was felt that depending upon image priority, product lead times could take anywhere between four and six months. Unfortunately due to the scale of catalogue production there were some cases of images taking longer than a year to be progressed. These were images which had been accepted to be part of the collection, but were then not selected to be in the catalogue. A more accurate picture of the scale of the problem in terms of product lead time needed to be established.

3.3.1 Flowchart

In the three month period between October and December 1993, a flowchart of the whole business was produced. Time was spent in each department understanding the work required to be done and which departments feed each other. As information was collected, it was also possible to establish the approximate times that each department believed were the processing times for their function. As no other information was available, these lead times were taken as a starting point for analysis.

The following table shows estimated lead times for the different types of image produced. The times are gained from figure 14 which shows estimated processing times for each department. These times were collected through interviewing staff during the creation of the flowcharts.

An image which is rejected after editing	22 days (4.4 weeks)
An image which is rejected after dupe selection	74 days (14.8 weeks)
An original for distribution	42 days (8.4 weeks)
A dupe not requiring imaging	112 days (22.4 weeks)
A dupe requiring imaging	123 days (24.6 weeks)

Figure 13 - Table showing estimated lead time for the different types of image produced

N.B. The term week is used to denote a working week of 5 days.

Department / Activity	Processing time
Despatch	1 day
Booking in	1 day
Editing	20 days (4 weeks)
Framing, Barcoding & Caption Writing	20 days (4 weeks)
Booking in to Dupe Selection	2 days
Dupe Selection	30 days (6 weeks) **
Booking in to Electronic Imaging	1 day
Imaging	10 days (2 weeks)
Booking in to Duping	2 days
Duping	5 days (1 week)
Dupe Quality Check	5 days (1 week)
Preparation for Outworkers	4 days
Outworker Framing	5 days (1 week)
Booking back, system modification, label printing	4 days
Outworker Labelling	3 days
Distribution	5 days (1 week)
Shipping, UK filing	5 days (1 week)

Figure 14 - Table showing initial lead time estimates from creating the flowcharts

** 6 weeks was the time quoted by the individuals responsible for the Dupe Selection function although no time is actually used as a working guideline.

At the time of creating the flowcharts, the managers were of the understanding that the average product lead time was in the order of 16 weeks (approximately 4 months). Just from initial investigation, the lead time for an image which needed full production appeared to be 24.6 weeks (approximately 6 months). It soon became clear that each department was not entirely aware of what either

the preceding or following departments did, how they affected each other, and what the consequences of delayed work could be.

The result of drawing up the flowcharts indicated areas where processes were repeated and areas where value was not really being added to the product. The largest contender for non-value adding activities appeared to be the number of queues that images were placed in awaiting some kind of processing.

Further work needed to be done to establish how much waiting time there was in the process.

Samples of the flowcharts can be seen in Appendix A.

3.3.2 Job Tracking Forms

In January 1994, a number of 'Job Tracking Forms' were entered into the production system to identify the following:

- How long a job (original, dupe, reject) takes to move through its relevant production activities.
- In the length of time a job is in the system, how much of that time is actually productive - i.e. adding value to the product.
- Where there are problems in the system which are preventing jobs from progressing through activities quicker (bottlenecks, high levels of WIP, non-productive delays between activities).

The above points proved to be particularly valuable for the areas at the beginning of the process which were not as linear as the later stages and so average processing times needed to be found.

The analysis of the production process using 'Job Tracking Forms' followed the path of images through the system, beginning where images are received as a submission and ending where either:

- Rejected images were returned to the photographer.
- Originals were filed.
- Duplicate images were distributed around the world and filed.

An example of a job tracking form can be seen in figure 15.

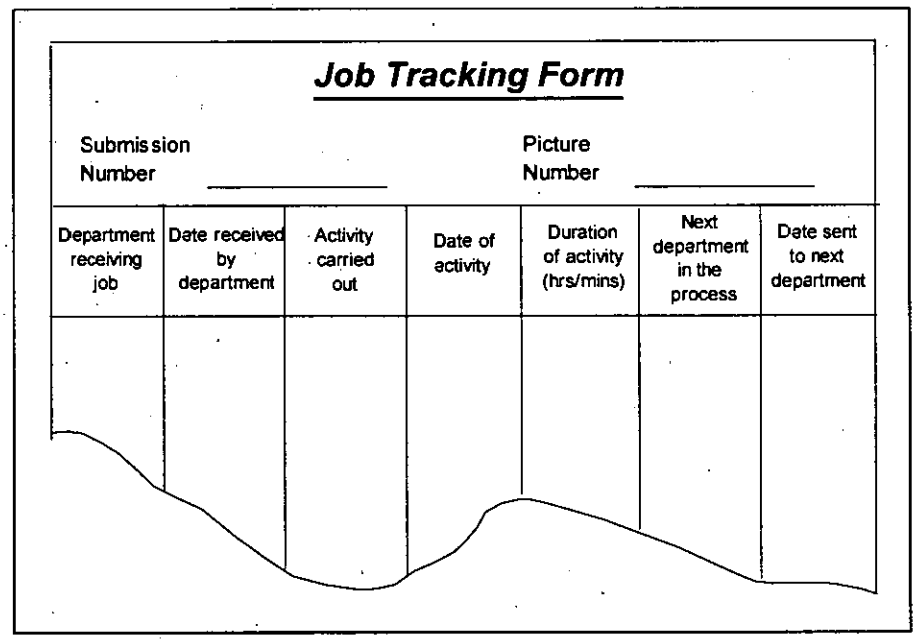

Figure 15 - Example of a Job Tracking Form

Job Tracking Forms were added to submissions on arrival and booking in. The form then stayed with the submission throughout the rest of its journey, even if it became split into originals and duplicates. In these cases the job tracking form was photocopied so that originals and duplicates from the same submission could be traced.

On arrival in a department the first and second columns were filled in, then when an activity was carried out, the activity, the date at which the activity was

carried out and the duration of the activity were all noted. When being passed on to the next activity in the process, the final two columns were filled in.

Of the 20 forms which were added to submissions, 15 were returned when the images to which they were attached were completed. The most accurate figures were gained for the earliest activities in the process. The reason for this is not known, however it is anticipated that although each department was informed of the analysis, the importance of day to day production overtook the recording of activities. Also the time between the issue of the forms and their arrival at later departments varied so much that the forms were perhaps forgotten. Some valuable information however about the Editing, Image Classification and Dupe Selection activities was collated. The table of results can be seen in Appendix B. The following chart shows the percentage of total time recorded that an image typically spends in each department.

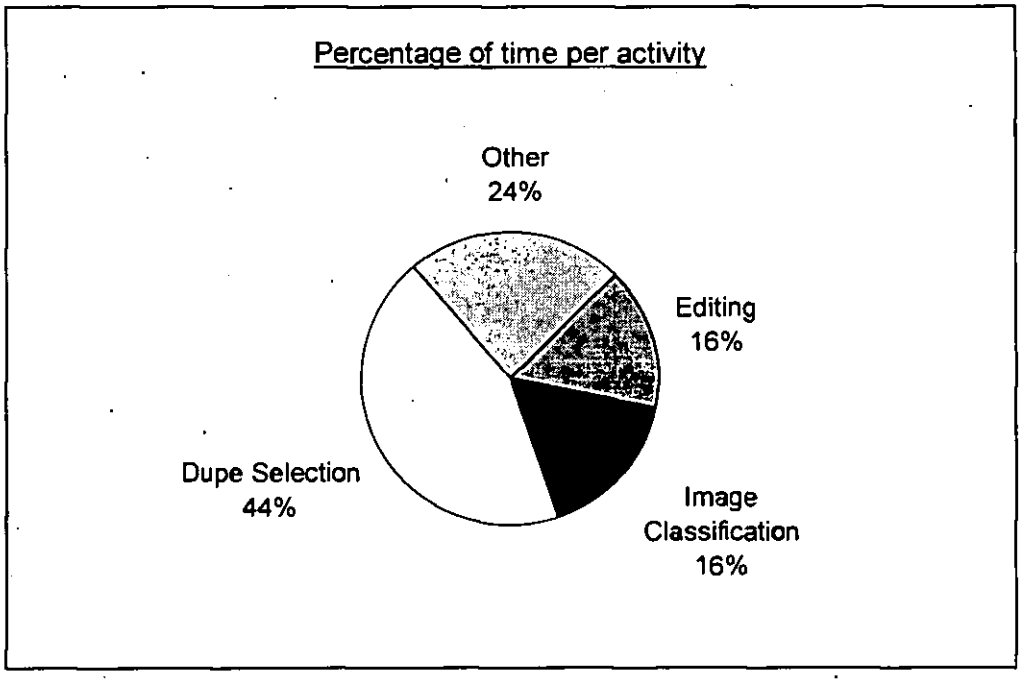

Figure 16 - Pie chart showing the split of time per production activity

The section labeled as 'Other' is information about other activities which took place but which was not common enough across the sample to detail. It included departments such as Duping, Despatch, Distribution and Electronic Imaging.

The main problem areas highlighted were editing and dupe selection. The images were held in these departments for a considerable length of time waiting for the next operation. When the activities which added value to the images did occur they only took a matter of minutes each. There is clearly room for improvement as these are areas where decisions are made about whether or not an image should be kept, and if it is kept, what its use should be. The time the images are being kept as Work In Progress, pending a decision must outweigh the time it takes to decide the fate of an image. The detail and possible solutions to these problems are discussed in Chapter 4.

3.3.3 Production Simulation Software

Over a four week period from mid January into February 1994, demonstrations of four production simulation packages were seen. Each simulation package matched and in some cases exceeded a list of requirements previously set, so the design, output and usability of the packages became the criteria on which a decision was based. The four packages were viewed as follows.

3.3.3.1 Service Model - PMC (Production Modelling Corportation)

Based near Warwick University, PMC are an agent for an American company, selling two simulation packages; ProModel and ServiceModel.

At the time, both packages were the same, however future developments intend to reduce the similarities between them. ProModel is very factory based, with simulations representing machine operations. The time for each activity can be accurately set and manual intervention is kept at a minimum. ServiceModel however caters for the service industries which are more manual, thus requiring more people based simulations to be set up. An example of a ServiceModel simulation is a telecommunications customer service office where the important factors are the length of time a telephone has to ring before it is answered and then once answered, how long a customer waits in a queue.

3.3.3.2 Witness - AT&T Istel

The Witness package is a product which was originally developed by the computing team from British Leyland Motor Company. Due to a management buy-out, the company changed its name to Istel and then in 1989 the computing company AT&T took over Istel. Since the take-over, AT&T have put forward substantial amounts of capital to allow the systems development programme to continue. Witness caters for the simulation of both manufacturing and service industries.

3.3.3.3 SIM Factory - Analysis Consultants.

SIM factory is a simulation package which is part of a range of software owned by an American organisation called CACI products. Analysis Consultants work as an agent for CACI in the UK and sell their products. As the name indicates, SIM Factory has been used for simulating manufacturing processes and now the company is considering releasing exactly the same product under a different name to cater for the service industries.

	ServiceModel	Witness	SIM Factory	AutoMod
Easy to learn	✓	✓	✓	✗
Easy to use	✓	✓	✓	✗
Rapid model build	✓	✓	✓	?
Good icon library	✓	✓	✓	?
Easy access to library	✓	✓	✗	?
Good graphics	✓	✓	✓	✓
2-D simulation	✓	✓	✓	✓
3-D simulation	✓	✓	✓	✓
Good stats output	✓	✓	✓	✓
View stats in simulation	✗	✓	✗	✗
Cost (£)	1500	1500	5000	700
Training (£)	900	650	?	inc. in cost
Support etc. (£p.a.)	750 (after 6m)	200	?	?
Total Cost (£)	**3150**	**2350**	**5000 + ?**	**700 + ?**

Figure 17 - Table showing the different functionality available in the four production simulation packages researched

3.3.3.4 AutoMod - Autologic Systems Limited

AutoMod is a simulation package which is part of a product range covering simulation and scheduling. The products were developed in America and the distributor for the UK was originally Frazer Nash Technology Ltd. Autologic Systems was set up after an agreement with Frazer Nash to take the distribution of the packages away from its core business.

Figure 17 is a summary of the analysis and assessment criteria used, along with a demonstration to decide upon the best package for simulating the production environment within TSI.

In summary, each package could perform the basic functions for a user to be able to build a model of a production process, run it and then retrieve some statistical information. The method of building a simple model is to select icons representing the activities, give them some parameters and then connect the activities with a work flow. Queues and variable feed rates etc. could then be set. The one exception was Automod which could build stock control simulations by selecting icons, however manufacturing simulations seemed to be very spreadsheet dependent.

The requirement for the package is to be able to quickly build a model of the current method of working at TSI. The model will then be used to find the ideal process layout and use of resources to allow the company to meet and exceed production targets. The package therefore needs to be easy to learn so that as little time as possible is taken up with training allowing the analysis work to begin as soon as possible.

Although AutoMod is the cheapest, it also seems very powerful, so much so that a large amount of time would be spent in training and learning the full capabilities of the system. AutoMod was disregarded due to these observations. The others, all seemed easier to learn and so would be in use quicker.

Sim Factory was rejected firstly due to its cost, and secondly due to the fact that the default icons were always skips for queues and tables for activities. These then had to be changed to fit the process being simulated. The icon library then had to be viewed by scrolling through the icons instead of being able to see them all at once on a grid and then selecting the one required. This package was deemed not to be ideal for the speed at which the simulation was required to be set up and operable.

Witness and ServiceModel are left and the only difference between them in function is the fact that Witness allows the viewing of the statistics as they occur instead of having to wait until the end of the simulation to compile the data. Also in terms of cost, Witness is slightly cheaper than ServiceModel. The package which was chosen was Witness.

3.3.3.5 Results and observations.

The production model was built using queues and activities, with entities flowing through. A sample of the model produced using Witness can be seen in Appendix C. In order to produce as accurate a model as possible, it was necessary to determine the beginning and the end of the process to be analysed. It soon became apparent that the following factors were key in gaining results from the model.

1. As was discovered through the use of the flowchart and the job tracking forms, the times for processing images through the creative section, i.e. the section where a decision had to be made about any submitted material was not constant. A statistical method for giving images random processing times had to be used.
2. At any one time, the mix of images going through the process is of different subject matter. This produced different outcomes in terms of how the image was dealt with or whether it was accepted or not. Again random statistical methods had to be used.
3. No allowance had been made in the model for rejecting work, reworking any rejects, or for the production of composite images. Composite images are

produced where two or more images are superimposed on each other to create an entirely new image. The ideas for composites can be generated anywhere in the Editing, Image Classification, Dupe Selection and Electronic Imaging departments. Random production of entities representing composite images would also have to be generated.

4. The duping process relied on the correct shift times for each camera being set up, as well as including the criteria for running certain types of image on the different sizes of camera. This proved to be very difficult to programme, but did however produce the right results for this area. The fact that duping is a weekly cycle meant that all of the entities arriving in any one week had to be completed before the following week. This was key in trying to establish some consistency in an otherwise random process.
5. Once duping was completed, the remainder of the processes were also dependent on weekly batches. Thus the process became linear.

The mix of random operations, many different types of entity and linear finishing processes made the resulting model very difficult to achieve. It was not possible to run the model for long enough to reach a steady state due to the duping programme producing more entities than the system was designed to deal with. The process of collecting enough information for building the model and running the inaccurate model that was achieved, reinforced the points which had been discovered from the flowcharting and job tracking form investigations.

The early part of the process through Creative, Image Classification, Dupe selection and Electronic Imaging is very random in all of the operations. This is essentially due to the nature of the product. The amount of work receivable from the photographers is unknown at any one time which makes the available capacity in the early operations either too great or too little to cope with the quantities present. Once one operation of a job is delayed, the overall date at which the job is expected to be completed by is also delayed.

The later part of the process from duping onwards is linear enough to maintain the flow of work, but is generally not flexible enough to catch up on any earlier

delays. The cameras in the darkrooms allow the quantity of work progressed to be monitored. Once the work passes through into framing and finishing, the workflow relies on the many pairs of hands to progress it. As the need for more images increased with the opening of new overseas offices, the need for more outworkers grew along with the cost of employing them. This raised the issue of automating the framing and finishing process - see section 4.7.

Overall, the use of a simulation package to determine the product lead time and evaluate alternative solutions to the operations employed was not as successful as originally anticipated. This was mainly due to the random nature of the business involving the images within the process and the unknown element in terms of sales demands and photographer submissions. The other issue was the inexperience of the Witness user. Many smaller models and easier situations should have been tackled before attempting to simulate the process within Tony Stone Images. Even then, it is possible that modelling would not have produced a realistic picture of the business and its operations.

4. Improvement Projects and Results

This chapter covers the improvement projects identified and implemented as a result of the production process analysis. The general outcome of each is also covered.

4.1 Image Checking

As images enter the system, they are counted and booked in by despatch and the editing department. In order to satisfy company sales policies, images of people are required to have a model release (permission from the model for the image to be sold in any capacity) and photographers who send in world travel and scientific shots are to submit caption information to help the caption writing process. The check for this information was originally intended to be done by the creative department during editing. Often one or both pieces of information are missing and this is not being picked up until the images are in Image Classification having captions written.

As a result of information being absent, the photographer has to be contacted for the missing information, by which time they could be on another shooting location. It became clear that a lot of time can be saved if the correct information is received with the images on submission. Missing model releases cause the most problems as the creative department would like to put through a potentially big selling image without a model release even though one is required. Model releases are necessary to protect the company against future legal battles with the models if any images are used to represent controversial issues.

Through discussion with the PIG a system was set up whereby the submissions were returned to the photographer depending upon the severity of the lacking information. The intention being to correct the problem at source. As in a standard manufacturing process this can be likened to improving supplier relations.

The photographers were all informed of the need to submit all of the image details together. Those with smaller quantities of images to manage responded well whereas those with larger volumes of images were not able to collect all of the information together.

Conflict developed between the creative department's need to put images through the process and not upset the photographers, and the production need to have all of the materials available in order to make the product.

An analogy can be drawn between the situation at TSI and a quality manufacturer such as the car industry. A car without a steering wheel cannot be sold and must remain in the factory which will cost the company money. By the same token an image of a person without a model release cannot be progressed for legal reasons and will cost the company money both in image storage and in lost sales.

The change was not a lasting success and images were soon back to being progressed without all of the information available. Two types of 'held' job were however identified; those whose queries could be dealt with immediately and those whose queries could not and so had to wait for longer. This concept is used later in the thesis.

4.2 Editing time

Figure 16 in section 3.3.2 shows that editing and Dupe Selection take up 60% of the total recorded time between them. These activities are essentially in decision making, where the next step for an image is determined. The assumption can therefore be made that if the time spent on decision making can be reduced, the product lead time can be reduced, thus also reducing work in progress.

From the information gathered, it was not possible to make any correlation between the number of images being edited and the length of time an edit was taking. For example, submission number 5562 had 19 images with a total

editing time of 123 minutes and submission number 5818 had 120 images with a total editing time of 73 minutes. The resulting images from the two mentioned submissions were different but they do show that there is difficulty in knowing the quality of the images within a submission before it is seen, thus editing times cannot be pre-determined.

Following discussion with the PIG group (for a members organisation chart see figure 10) and the Creative department, agreement was made to more closely monitor the length of time a submission is in Creative and keep it to within 4 weeks where possible. Four weeks is the time-frame previously agreed by Creative to turn work around and this decision required it to be enforced where possible.

A rack containing a series of pigeon holes for each of the 6 editors has been installed. There are four pigeon holes for each editor representing the 4 weeks in which work can be in the department.

When submissions are entered into the department they are assigned a four week deadline. The submissions are monitored by the creative coordinators who move the submissions along the pigeon holes as each week passes by. The editors know that any submissions in the current editing pigeon hole have to be edited to keep up with the 4 week editing deadline. The changes provided the department with greater visibility of the progress of work and the quantity of work in the department.

As different subjects passed deadlines for the catalogues or were the current image trend, some editors had more work pending than others. Although each editor is responsible for the communication between a certain group of photographers, it has been possible for the Creative Manager to share out the task of editing to enable the department to meet deadlines.

The new process has, on the whole, been well received and has allowed more stability to be maintained over the department. The managers are also

beginning to understand the departmental editing capacities. Although the human element involved and the unpredictable mix of images makes measurement intangible, a better idea of what can and cannot be achieved has been gained.

4.3 Second Editing.

Although the figures are not shown in the table, there were 7 submissions recorded as having a second edit. Six of these submissions show that it is taking on average a further 5 working days for the second edit to be completed. A second edit generally takes place where editor training is being carried out and a second opinion is required on some work.

The first and second edits result in some images being returned to the photographer. A recommendation was made to the effect that, if the time between the first and second edits can be reduced or even removed, the images to be returned to the photographer can be removed from the system quicker, with only wanted images remaining.

After discussions covering the value gained from second editing, it was felt that the second editing process did not add a great deal to the overall outcome of the images within a submission. The editing department was also experienced enough such that second editing has become redundant as an educational process to the newer editors in the team. Second editing has successfully been removed from the process.

4.4 Bar-coding, Framing and Caption writing.

The Image Classification department is responsible for receiving edited images from creative and preparing them for the next stage in the process. Images which are to be kept as originals are framed and images which are to be duplicated are placed in plastic sleeves. Every image received from editing then has a bar-code added which is then entered on the system. From this point on, original images are identifiable by their bar-code. Duplicate images have bar-

codes entered further down the production process. Once images are framed / bagged and bar-coded they are put in boxes awaiting caption writing.

If catalogue production is underway, any images which fall into the subject matter covered by the catalogue have priority over the rest. They have their caption written first. Then any normal dupes have their captions written and the originals have their captions written last. Each time, the submission is returned to a box to await the next process.

The bar-coding and framing process is undertaken by different staff to the caption writing process. Bar-coding and framing tends to be quicker than caption writing resulting in a large backlog building up between the two processes.

It was suggested that the staff in the Image Classification department be trained together to become multi-skilled and individually manage a whole submission from start to finish through all three processes; framing, bar-coding, and caption writing. The advantages of this were that although the number of completed images leaving a department in any week would probably fall, the levels of work in progress would also fall as there would no longer be a stock of part-completed submissions waiting in the department. The fact that the department, like so many production processes is measured on output as opposed to quality or efficiency, the suggestion was dismissed as not viable.

4.5 Dupe Selection

This is the process by which the images originally selected for duping from editing are edited a second time to clarify the original decision and to place some routing and handling instructions to the images. The routing instructions are largely self governing due to the sizes of the originals being handled. The cameras upon which the images can be duped are determined by the size of the original and the amount of enhancement required. The main problem is that Dupe Selection as a process only happens once a week and for a designated subject area. The number of images handled in any one session did not equal

the number of images entering the department on a normal week's output from Image Classification. Large backlogs have built up so much so that it is not unusual for an image to spend 6 months waiting to be progressed. By which time the image may have missed the catalogue deadline or the type of image is no longer required.

Two rather startling results from the submission tracking forms were obtained.

1. An image entered the company as part of submission number 5764 on the 8th February 1994. It entered Dupe Selection for the first time on the 3rd May 1994 (approximately 3 months later). This image then went through the dupe selection process and was sent to the darkrooms by the 9th May 1994. The image was returned to Dupe Selection at some point and was booked out of Dupe Selection for the second time on the 24th March 1995 - over one year after the submission was booked in.

2. An image entered the company as part of submission number 5809 on 28th February 1994 and was entered into Dupe Selection on the 29th June 1994. The image was booked out of Dupe Selection for duping on the 6th April 1995 - again over one year after initial submission booking in.

Where two examples have been recorded, there must be hundreds of other images to which the same thing is happening which are not logged by the submission tracking process. Dupe Selection seems therefore to have a large impact on the delay of images just through the need for a second decision making process to take place.

It has become clear that to reduce the overall production lead time (which is proving to be harder and harder to measure as work progresses through the process) the decision making operations need rationalising. One suggestion has been made to combine all of the decisions which have to be made into one process. i.e. the decision whether or not to keep an image, whether or not to dupe a kept image and the route an image which is to be duped took should be

made all at the same time. It was intended to run a trial of the suggestion to test its feasibility, however the immediate concerns of the Creative department meant that during the period of the TCS this trial did not take place.

4.6 Building Re-organisation

Figure 12 in section 3.3 highlights the amount of movement required to process the images. One upshot of the analysis work being carried out was the decision to restructure the department layouts to allow work to be more visible and transportable. This has become more critical as production volumes have increased. The top floor of the building is now administrative so that no work needs to be moved up through the building in order to come down again. The company has also acquired some off site office space from which to operate the Framing, Finishing and distribution process.

Goldratt and Cox (12) described the 'Theory of Constraints' which concentrates on making the bottlenecks within a company visible, allowing them to be dealt with. It is stated as being a continuous process as for every constraint removed, others appear. TSI made some headway down the road of identifying the constraints as reorganising the building has taken some of the emphasis away from the levels of work in progress between departments allowing the focus to be on the processes themselves and where they may be causing delays.

The following diagram shows the layout and flow of work through the building as of June 1995. In comparing figure 18 with the original building layout in figure 12, it can be seen that the second floor is no longer part of production so keeping the work flow to lower levels.

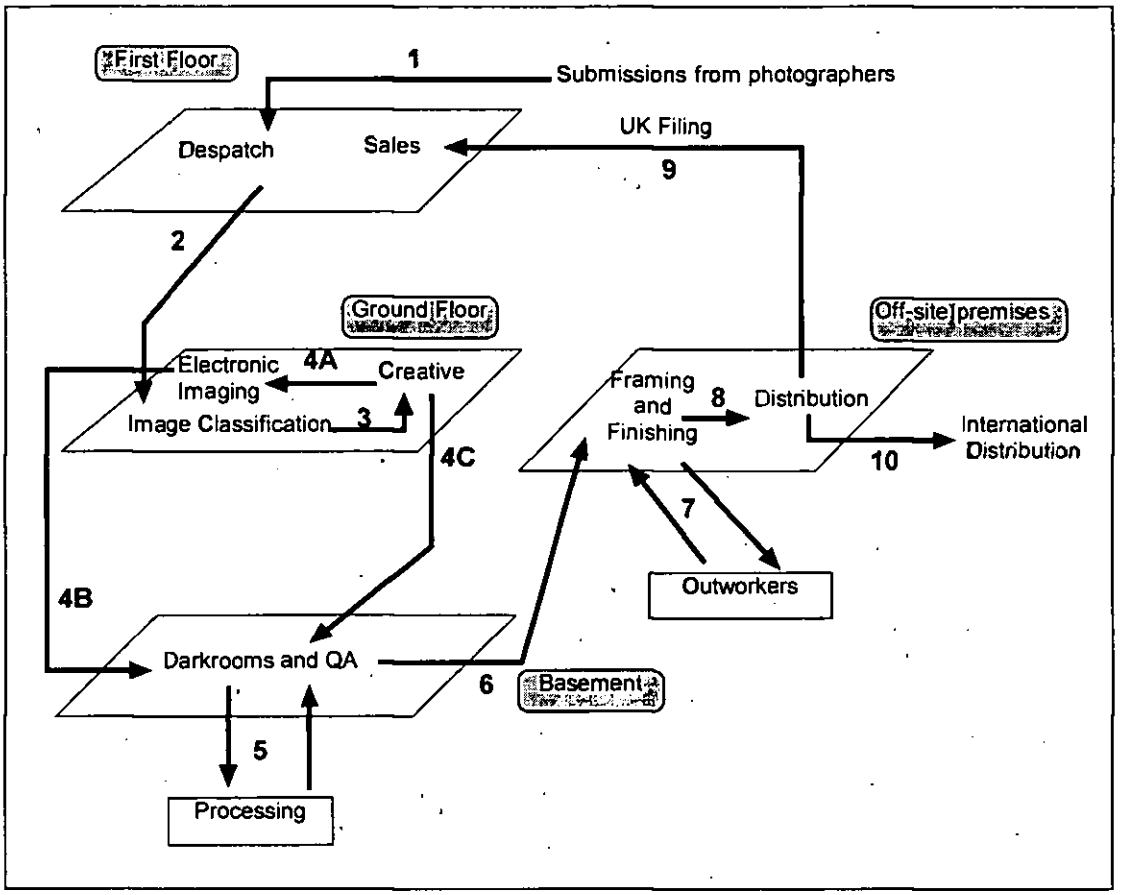

Figure 18 - Diagram showing the building layout and flow of work in June 1995

4.7 Framing and Finishing.

From investigations with the Framing and Finishing department the various operations involved are taking the following times:

Receiving images from the darkrooms and preparing them for the outworkers	5 days
Images are framed and finished at the outworkers	5 days
Images checked back and labels printed	3 days
Images sent to outworkers for labelling	3 days
Images returned and sorted into countries for distribution	5 days

Figure 19 - Table showing average operation duration in Framing and Finishing.

It soon became apparent that the framing and finishing process, up until the images are sorted into countries for distribution was extremely labour intensive and time consuming.

At the beginning of every Teaching Company Programme, associates are expected to complete an induction course which takes place over two one week sessions. There is a two week period between the sessions where a mini-project is carried out. It is designed to give the associate more insight into the company in which they are working. The mini-project for Tony Stone Images was to carry out a feasibility study into automating the framing and finishing process to reduce the throughput time considerably from 16 working days. The feasibility study initially involved a company called Loersch in Germany, however during the period of the Teaching Company Scheme a total of three organisations were consulted on the possibility of automating framing and finishing.

The initial study involved a German company by the name of Loersch. Although the full report can be seen in Appendix D, the following tables show some significant costings in terms of predicted spend by continuing to use outworkers against potential savings to be made by automating the process.

	1993	1994	1995
Production forecast	**663,220**	**1,105,188**	**1,122,000**
Number of working weeks per year	48	48	48
Number of dupes requiring completion per week	13817.08	23024.75	23375.00
Average number of dupes completed by outworkers per week (current)	15500		
Wages per 20 dupe units (£)	2.15		
Total wages per average week (£)	**1666.25**	**2475.16**	**2512.81**
Cost of mounts per 100 (£)	4.10		
Total cost of mounts per average week (£)	**635.50**	**944.01**	**958.38**
Cost of sleeves per 100 (£)	7.50		
Total cost of sleeves per average week (£)	**1162.50**	**1726.86**	**1753.13**
Cost of picture labels per 1000 (£)	5.42		
Total cost of picture labels per average week (£)	**84.01**	**124.79**	**126.69**
Cost of bar codes per 1000 (£)	8.50		
Total cost of bar codes per average week (£)	**131.75**	**195.71**	**198.69**
Cost of sellotape per box - 24 rolls (£)	13.43		
Number of rolls used per week	40.00	66.66	67.67
Total cost of sellotape per average week (£)	**22.38**	**37.30**	**37.87**
Labour cost of labelling at 600 labels per hour (£)	4.9		
Number of hours required for an average weeks work	25.83	38.37	38.96
Total cost of labelling per average week (£)	**126.58**	**188.04**	**190.90**
Outworkers transport costs per week (£)	10	10	10
Outworkers transport costs per year(£)	**480**	**480**	**480**
Total cost of dupe finishing per average week (£)	**3838.98**	**5701.87**	**5788.46**
Total cost of dupe finishing per annum (£)	**184,270.88**	**273,689.81**	**277,845.85**

Figure 20 - Costs of manual Framing and Finishing for forecasted production figures

	1994	1995
Production forecast	**1,105,188.00**	**1,122,000.00**
% of dupes to be finished automatically	88.6	88.6
Number of dupes to be finished automatically	**979,237.00**	**994,103.00**
Number of working weeks per year	48.00	48.00
Annual cost of mounts and sleeves @ £100 per 1000 (£)	**97,923.70**	**99,410.30**
Annual cost of labour @ £12,000 per employee	**24,000.00**	**24,000.00**
Cost of picture labels per 1000 (£)	5.42	5.42
Total cost of picture labels per year	**5,307.46**	**5,388.04**
Cost of barcodes per 1000 (£)	8.50	8.50
Total cost of barcodes per year (£)	**8,323.51**	**8,449.88**
Cost of weekly power usage of 500W per hour @ £0.084 per KW/hr	1.47	1.47
Total cost of power per year	**70.56**	**70.56**
Total cost of dupe finishing per year (£)	**135,625.24**	**137,318.77**

Figure 21 - Cost of automatic Framing and Finishing for forecasted production figures

The initial investigations based on estimated machinery costs and production forecasts showed that for 1994:

The cost of Dupe finishing using outworkers = £273,689.81
The cost of Dupe finishing with automation = £135,625.24

A potential saving of approximately £140,000 could be made in 1994. It is clear that further investigation is required in order to source machinery and further justify the benefits of automating a high volume process.

The three organisations investigated during the period November 1993 to July 1995 are as follows:

- Loersch
- C.B.L. Tool and Engineering Co. Ltd.
- Robotec

The main issue with finding automation for the framing and finishing department is that TSI duplicates images onto 70mm film. All of the 'off the shelf' suppliers of photographic mounting equipment cater for the 35mm film market, creating small slides. This is not ideal for TSI who market the product on the basis that as the images are larger than the competitor's product, they are easier to see and can be seen in more detail. This being the case a piece of bespoke machinery is required.

Figure 22 shows the process required to be automated for Framing and Finishing.

4.7.1 Loersch

Loersch is a German based company which specialises in the manufacture of 35mm slide mounts. As a side line to the main product the company has developed a series of machines to place 35mm film into the mounts, add printed captions, and if required insert the slides into sheets of A4 display pockets for ease of archiving and retrieval.

Loersch was approached to work with Tony Stone Images in developing similar technology for 70mm film. Drawings for a machine have been produced, however there are difficulties in finalising the contract as Loersch require that TSI use Loersch as their supplier for the raw materials to run on the machine. As TSI has very good contracts with current suppliers it is felt that the risk of unknown overseas supply is too great. The possibility of working with Loersch to develop a machine has not been totally dismissed however TSI have decided to explore other avenues before making a commitment.

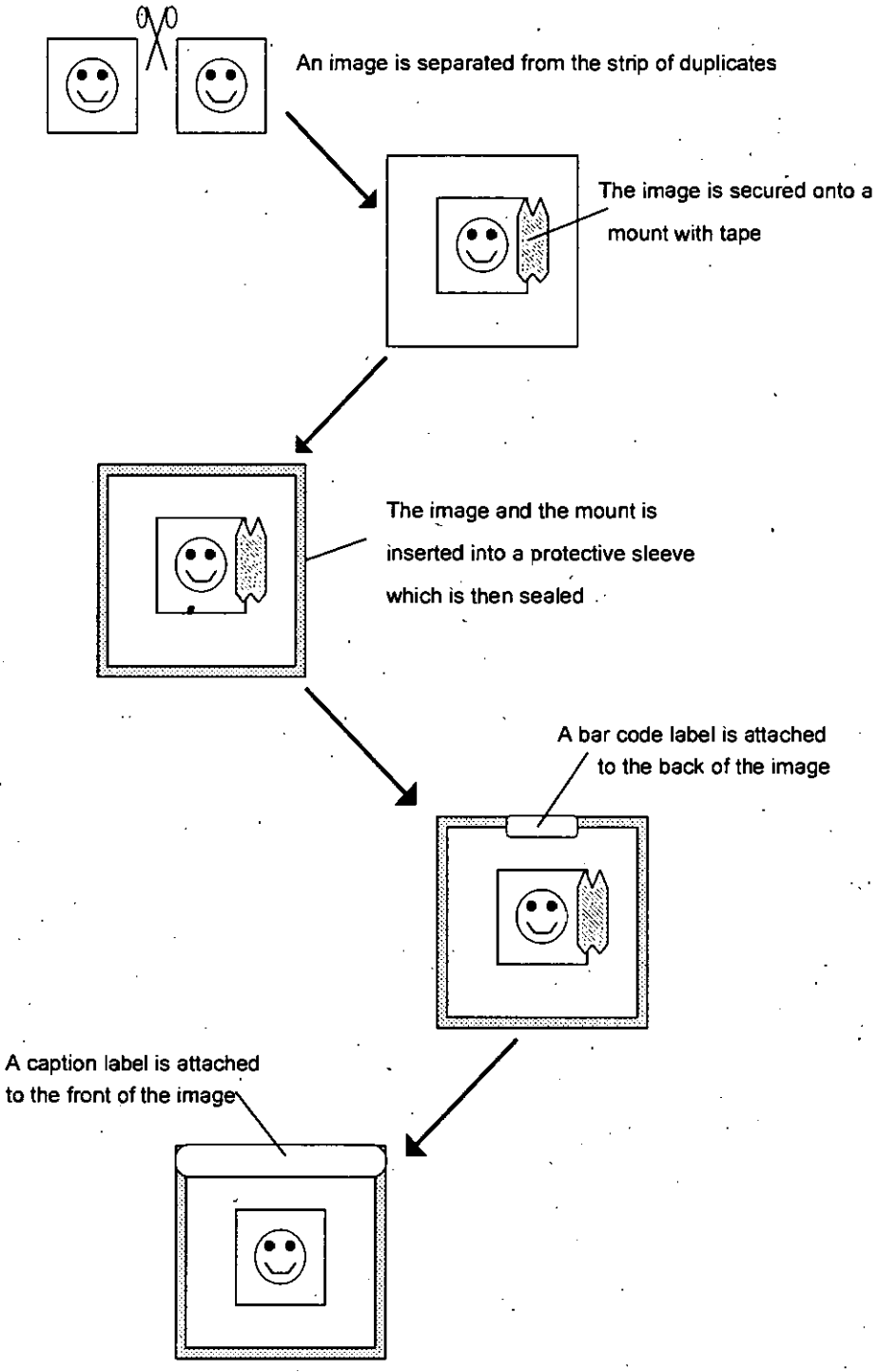

Figure 22 - The framing and finishing process at Tony Stone Images

4.7.2 Tool and Engineering Co. Ltd.

C.B.L. Tool and Engineering Co. Ltd. were a contact obtained through the supplier of the transparent sleeves which Tony Stone Images use as protective covers for mounted images. The company provides the supplier of the sleeves with the machinery to make them in a continuous process. It was originally

thought that having an involvement in building machinery, C.B.L. could provide a solution without having to change the raw material suppliers.

A problem encountered by C.B.L. is that each camera in the darkroom has a different measurement between each frame on the film. This makes it difficult to build a machine which is able to detect the beginning and end of each frame mechanically; i.e. by counting the number of sprocket holes along the edge of the film for cutting accurately. The alternative is to use a light source which can detect the beginning and end of each frame by shining light through the image. This will only work however for about 70% of the total images as others have dark backgrounds which run directly into the rebate on the edges of the film and so would not be detected.

After a period of about 4 months experimentation, C.B.L. withdrew from developing a machine as no solution could be found to overcome the image detection problem.

4.7.3 Robotec

Robotec is a UK company based in Nottingham. They specialise in providing solutions for one off production problems. Robotec was originally approached with the possibility of providing a solution to sort bundles of images into countries prior to distribution to the offices and agents.

TSI then asked Robotec about the possibility of tackling the automation of framing and finishing when it seemed that C.B.L. were no longer able to provide a solution.

After carrying out a full survey of the process and collecting samples of film and framing materials Robotec decided to create a machine which has different settings depending upon which camera which produces the roll of film. This way the machine can detect the beginning and end of an image according to the camera on which it was originally shot.

A major breakthrough in solving the problem for TSI coupled with a solution which can use existing raw materials allowed a contract to be placed with Robotec for two Framing and Finishing machines.

The contract was placed with Robotec after the Teaching Company programme had finished and it has since been learned that in the later part of 1995, Robotec went into receivership. It is understood that some of the staff are forming a splinter company to fulfil any remaining contracts.

4.8 Achieving the Production Business Plan

Two significant parts of the 1994 / 95 business plan were:

1. To move the company towards more continuous catalogue production, i.e. 3 per year instead of 1.

2. To increase the production of first time dupes from 10,000 new images in the collection per year to 15,000 new images. i.e. a 50% increase in production output.

The concept of continuous catalogue production demands that the processes contributing towards the completion of a catalogue are running as efficiently as possible.

Not only do catalogue pictures need duplicating for circulation around the world, but many thousands of pictures which are extremely saleable and do not appear in the catalogue also need duplicating to maintain a good selection of back-up images for the library. The company also has a policy of adding a certain number of original images to the collection every year. Although originals do not need duplicating, they use up capacity in areas such as editing, caption writing, framing and finishing. The ideal operating environment is for images to be constantly progressed through the system with no long-term detriment to those images seen to be less important than the catalogue images.

Balancing the production process to cope with the various types and treatment of images is vital if the company is to achieve the production target of 15,000 new images, continue growing and remain competitive. If TSI has to fight for the production of every image, it will eventually exhaust the flexibility the system has due to the high levels of manual as opposed to automated activities. Although it would be ideal to operate with manual flexibility for large production volumes, people are not machines and so cannot be treated as such. Extra effort can be requested for finite periods of time to reach deadlines, for example, but cannot be requested indefinitely to cope with an increase in production and an inefficient working methodology.

The area of the business focused on by the executive in order to arrive at the goals for the business plan was the darkrooms. The darkrooms housed the duping function where a single image was duplicated many times to produce the many images circulated around the world.

In order to meet the two main business plan goals as identified earlier, the company looked at the capacity of the darkrooms and worked out how many extra shifts were required to allow the extra quantity of duplicate images to be made. This involved the building of a new darkroom.

Steve Lamb (13) discusses the area of choosing the right tools to build successful solutions. One danger could be to implement local solutions to meet immediate problems. These are solutions which cannot be coordinated into a one corporate-wide enterprise solution within a short time-scale.

The decision to increase production is in effect a problem which TSI has brought upon itself. The problem has been 'solved' by building the extra darkroom to allow the extra dupes to be made. This only shifts the problem onto the next operation, indicating that the consequences of the decision for a 50% increase in production output had not been fully thought through.

In order to fully understand the company's capabilities in term of catalogue production, a critical path analysis was carried out. The chart follows the role of the publications department in conjunction with the production process. Many of the production activities can not be measured in terms of duration so estimates have been taken.

The full critical path analysis can be seen in Appendix E.

Two critical path analysis results were obtained. One for specialist catalogues and one for flagship catalogues. The results from the critical path analysis were as follows:

A specialist catalogue is designed to have a shelf life of approximately 5 years. It covers one particular subject area in many ways. The two specialist catalogues produced between 1993 and 1995 were 'Visions of Nature' and 'Business and Industry'. Future specialist catalogues will include areas such as 'Sport and Leisure' and 'Health and Beauty'. The critical path analysis for specialist catalogues followed the activities to be done by the Creative and Publications departments and resulted in a lead time of 49 working weeks.

A flagship catalogue includes imagery from all of the subject areas represented by the company. A flagship catalogue is launched in the early part of every year and has a shelf life of approximately 3 years. The flagship catalogue had a critical path lead time of 53 weeks which also followed the activities of the Creative and Publications departments.

It is clear that with the current resources available in the company the production of 2 catalogues per year is possible, but 3 is not. In order to make 2 catalogues per year the processes will have to be overlapped. The creative activities of sourcing new images for one catalogue will be starting whilst the production processes of the last catalogue are being completed. It is however interesting that on initial investigation the Darkroom, Framing and Finishing functions appear to be resourced adequately to achieve the deadlines required

by the production of a catalogue. The affect however that this has on production being able to maintain an adequate supporting level of mainstream imagery is not known.

Careful thought and many changes will have to be made to allow the company to grow by such large percentages and produce 3 catalogues per year at the same time. The kind of changes made by the PIG and PMG are helping the company become more efficient at current levels of operation, however greater changes need to occur to allow controlled growth. Part of this control can be gained by better and integrated systems allowing full tracking and recording of all of the images in all stages of production.

5. Systems supporting the Production Process

5.1 Systems in Use

In the first stages of the project, the main system supporting the company was known as TSLIB (Tony Stone Library). This was replaced in January 1994 by a system known as ICATS (Image Coding at Tony Stone). The following systems description covers the support for the company after January 1994.

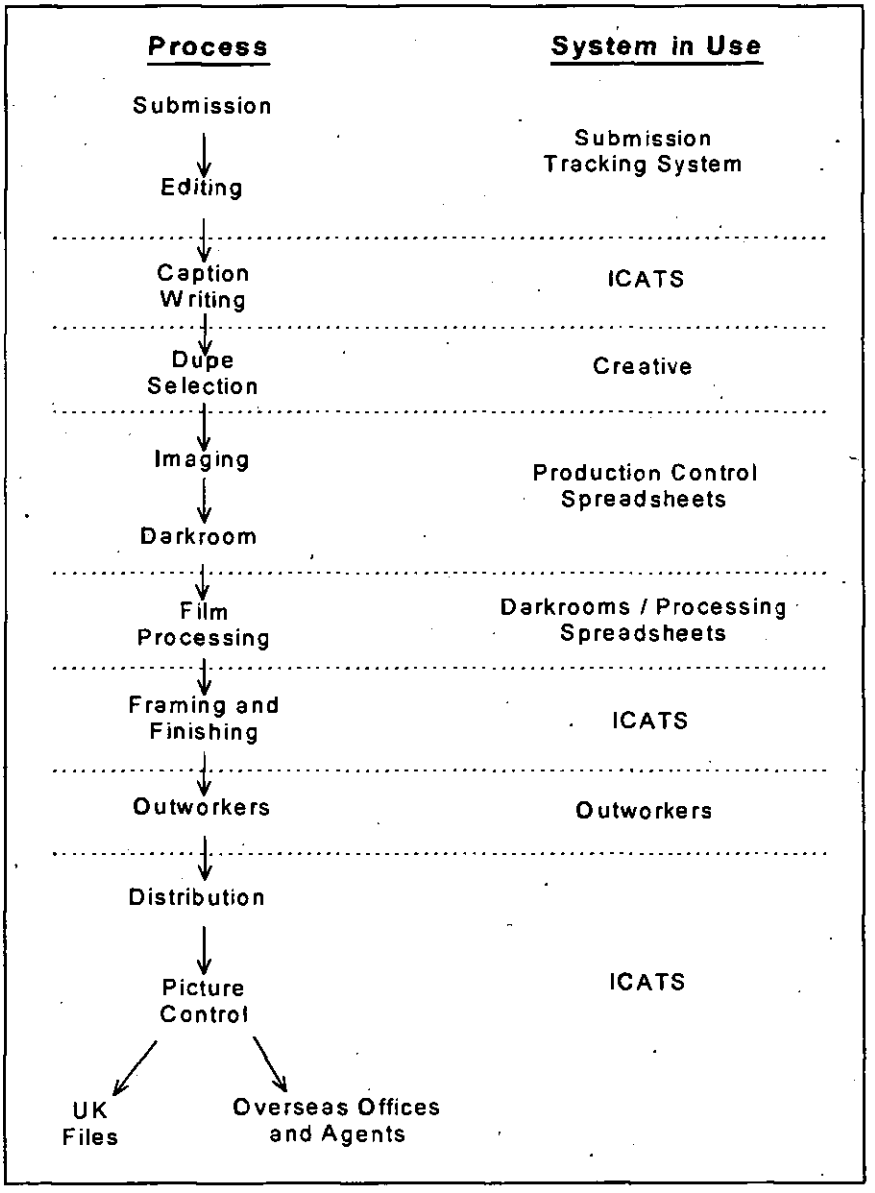

Figure 23 - Systems in use at Tony Stone Images '93 - '95

5.1.1 The submission tracking system

This is used by the Creative end of the business to record the fact that images have arrived as a submission and that they have been allocated a submission number. Other information that is collected concerns the photographer's details and the number of images in the submission. Once the submission has been edited, this system also records the number of images which have been retained as the result of editing, and the number which have been rejected. Those which are rejected are returned to the photographer. Of those which are retained by the company, they are classed as either dupe possibles or originals. The only other area of the company that has links with this system is the darkroom.

5.1.2 ICATS

ICATS stands for Image Coding at Tony Stone Images. This system was implemented as the central library system and controls the areas where images are added to the system and the sale of images. For Production, images are added onto ICATS in image classification after editing. In image classification, the images which are to be kept are given a unique number for identification and are also given a caption. Other information is recorded at this time to determine whether or not an image has any 'sisters' (see section 5.1.2.2), whether the image requires a model release and which filing codes the image needs to determine where in the library the image should be held. Once images have been duplicated, the ICATS system is used later in the process to record all of the duplicates and any changes which have to be made to the image during processing. It is also used as a transaction record for identifying which images have been distributed to other Tony Stone offices and agents around the world, and sold to clients.

5.1.2.1 Identification Numbers

In order to become part of the Tony Stone Images Library each image is given a unique identification number. This helps with recognising the image for sales and production purposes. The number is structured as follows.

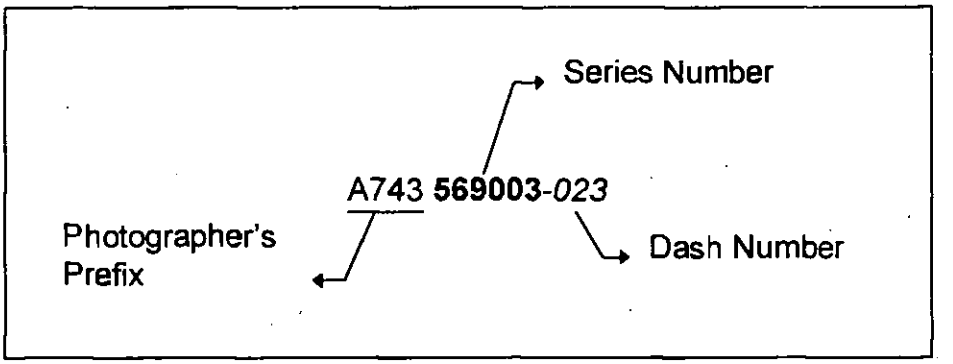

Figure 24 - Image Identification Number Structure

The photographer's prefix is used by the accounts department for calculating how much to pay the photographer when the image is sold. A photographer may have more than one prefix as different projects can be financed in different ways. The series number is unique to the image and for the example given, the image is the 596,003 image to be added to the library. The dash number identifies any sisters attached to the image. The example shows that the image has dash number 23. This means that the image is one of 23 or more sisters in the series. All sister images have the same series number and it is the dash number which identifies them apart from the others.

5.1.2.2 Sisters

Sister images are images which have been taken on the same day, with the same models, the same setting and the same theme but the composition of the images vary slightly. For example, images of a business man in different positions whilst making a telephone call would be sister shots, whereas images of the same business man in different scenes; in a meeting, on public transport, having lunch etc. would not be classed as sisters.

5.1.2.3 Model Releases

Depending upon the composition of the image, a model release may or may not be required before the image can legally be sold. An image requiring a model release is usually an image of an individual or a group of individuals. In order to have a model release they must be identifiable. The whole reasoning behind model releases is to protect the company against any future uses of the image. For example, an image may exist of a woman with very beautiful skin. This

image may then be manipulated electronically to show the woman with spots on her face. The before and after images of a woman with and without spots could then be used by a pharmaceutical company to advertise a skin treatment. The model in the image signs the model release when the images are taken which then permits the company to use the image in any way without any legal repercussions.

5.1.2.4 Filing Codes.

When an image is accepted into the library, it is given a filing code so that it can be found easily. All of the images at Tony Stone Images are stored as hard copies in files and not electronically, images are therefore required to be traced numerically, much like a book lending library. The filing codes group the images together in subject categories and are made up of two parts. The first part groups the image in a broad way and the second part sub-divides the category into the kind of areas customers would ask for when requesting images.

E.g. the filing code DO-AI would represent Dogs (DO) and Adult Indoors (AI).

5.1.3 Production Control Spreadsheets

Since the number of images within the company has grown and the systems which were implemented are not integrated, many images are lost and misplaced between operations. In the areas controlling the movement of images between Creative, Dupe Selection, Electronic Imaging and the Darkrooms various excel spreadsheets were set up to try to account for the number of images in each section and their status for production. The spreadsheets have quickly become cumbersome and difficult to manage, often with thousands of records in them and only one person at a time able to access data which is required by four different departments. Although they are useful and necessary for the growing industry, spreadsheets are by no means ideal and should never have been looked upon as a long term solution.

5.1.4 The darkrooms system

As well as having spreadsheets to book work in and out of the department, the darkrooms also operate a system which although is linked to the submission

tracking system for queries is essentially stand alone, to check work in and out of processing and to book work to the dupers. The dupers also use the system to book their week's allocated work as complete, one job at a time. The information stored by this system is useful as an internal tracking system along with the spreadsheets but does not feed any other system in the company and is often of little use if an image has to be reduplicated, as the conditions in which the image was made the first time can not be matched exactly the second time around. Any camera settings which were recorded, could not be used as anything more than rough guidelines to help the duper match a duplicate image to its original.

5.1.5 Outworkers Spreadsheets.

Part of the product finishing process involves sending batches of images to outworkers for framing and finishing. A spreadsheet has been set up to monitor the quantities of work sent out each week and returned each week. This also helps with traceability of which jobs are out of the building and which outworker they are with. This spreadsheet is completely stand alone and does not link with any other information gathering exercises around the company.

From the descriptions of the systems given it can be seen that a lot of information is being collected in many different areas without any structured method of collating the information into a meaningful report which can be used to monitor the business.

The system is very disjointed and needs rationalising if the business is to achieve target growth as determined by the business plan (section 4.8) and long term development.

5.2 An Integrated Production Management System for Tony Stone Images

Halevi (14) spoke of the Integrated Manufacturing System as

'A system that recognises and supplies computer services to each phase of the manufacturing cycle independently, while at the same time maintaining a database that serves as a single source of data for all company activities and applications'

It is not possible to consider a full company-wide system for TSI, however that coupled with the improvements already made due to the PMG and PIG meetings, a production planning and control system can begin to take shape. It is necessary however to establish which elements make an ideal system and adopt as many of them as possible.

Halevi suggested that manufacturing is only one function of many in an organisation. It is however a dominant one as it controls much of the daily activities of the other functions. The integrated manufacturing system must consider all of the activities in all of the functions in the enterprise.

5.2.1 Current Systems vs Ideal Systems

In order to establish how much work needs to be done, the current systems were compared to the structure of an ideal system by the following points.

- **Information needs to be easy to find**

In an ideal system, information should be easily accessible to all who require it and as random enquiries. Users should be able to access information from anywhere in the organisation about any department.

Currently, information within TSI may be old, lost, inaccurate or be so difficult to access that time is wasted and managers become frustrated. This is particularly the case for those departments within TSI whose systems are

relatively stand alone. As an example, the submissions tracking system can provide all kinds of information about the numbers of images entering the department, but only to those with access to the system (Creative). It is probably the case that it has never been seen to be important to the next department down the line (Image Classification) to know in advance what kind of volumes to expect. Having this information would however allow Image Classification to determine the best way to use the staff to cope with the amount of work coming through.

- **Data should be entered only once**

In ideal systems individual data items should only need to be entered once and then the structure of the underlying database tables of the system should allow the data to be extracted in many different ways.

In TSI, again as the system has boundaries, the coordinators of each function find themselves entering data onto a new system which has already been entered previously. The main problems caused by multiple entries of the same piece of data are:

1. Mistakes are made when data is being keyed in.
2. Entering data is time consuming, especially once an image is duped and has hundreds of copies.
3. Data can sometimes be missed. When an individual is entering data from a long list, items may get overlooked.

Nearly all of the mistakes made are human and by introducing single data entry, the above problems would disappear.

5.2.2 Standard Formats

Ideal systems should display commonly used data items in the same way across the organisation, e.g. product part numbers being known in the same

way across all of the departments. As well as being easy to do, it promotes standards across the business for identifying product or processes.

At TSI, the main identifier for an image is the picture number (see section 5.1.2.1). This does have standard use across the company apart from one department. Due to the potential to produce composite images, the electronic imaging department use their own unique job numbers whilst an image is in the department. This works well for the department as all of the original picture numbers for the composite parts are referenced and the department can recognize the image by its job number. The job number is not used anywhere else in the organisation. Once a composite image is complete, it has a new series number attached before continuing its journey. Number structures do not appear to be a problem within TSI.

5.2.3 Real Time information

The minute a transaction is made on a system, it should be able to be seen by all users in all departments. This does not appear to be the case at TSI as not all of the users have access to all of the systems and not all of the systems are updated instantly. This needs to be improved for better efficiency.

5.2.4 Company Performance

The ideal system should provide overall information about the company to higher managers and departmental supervisors to allow decisions to be made for the short, medium and long term future based on hard and real information.

Currently at TSI information is gathered at a very low level on the systems and the only consolidation process is very labour intensive where the supervisors of each department all submit their weekly progress sheets which are then collated and distributed amongst senior managers. The information is already over a week late and so it is probably too late to do anything to correct any problems which may have been occurring. TSI could benefit greatly by being able to access the following:

1. Accurate figures for product lead time
2. WIP levels - per department and company as a whole

3. Pinpoint process bottlenecks

The job tracking forms have already shown that there appears to be a problem with the length of time it takes for an image to get through Dupe Selection depending upon whether or not it is destined to be a catalogue image. The company should not need to enter job tracking forms into the process and wait over a year to enable this scale of monitoring to be done.

Apart from the way it is envisaged that an ideal system needs to operate at TSI, the following are questions raised by the author and members of the company through experiencing the deficiency of the current systems in terms of manufacturing information.

1. How many images are there in the process as a whole?
2. How long are images spending in the process (shortest, average, longest)?
3. How much re-work is carried out in the electronic imaging and duping departments?
4. Why can't sales query on the status of a re-duped image which has been promised to a customer?
5. Why can't the overall output be measured?
6. How long before an image is sold did it enter the files?
7. How often should the files be cleared of old images?

A system needs to be developed to provide TSI with the answers to current questions which is also flexible enough to grow with the business an continue to monitor production at different levels.

5.3 A system strategy to fit Tony Stone Images

It would be nice to be able to take an 'off-the-shelf' MRPII system (Manufacturing Resources Planning) and implement it at TSI. The following diagram taken from Corke's (15) book 'A guide to CAPM' (Computer Aided Production Management) shows the typical sections within a MRPII system and has been simplified for use in this case.

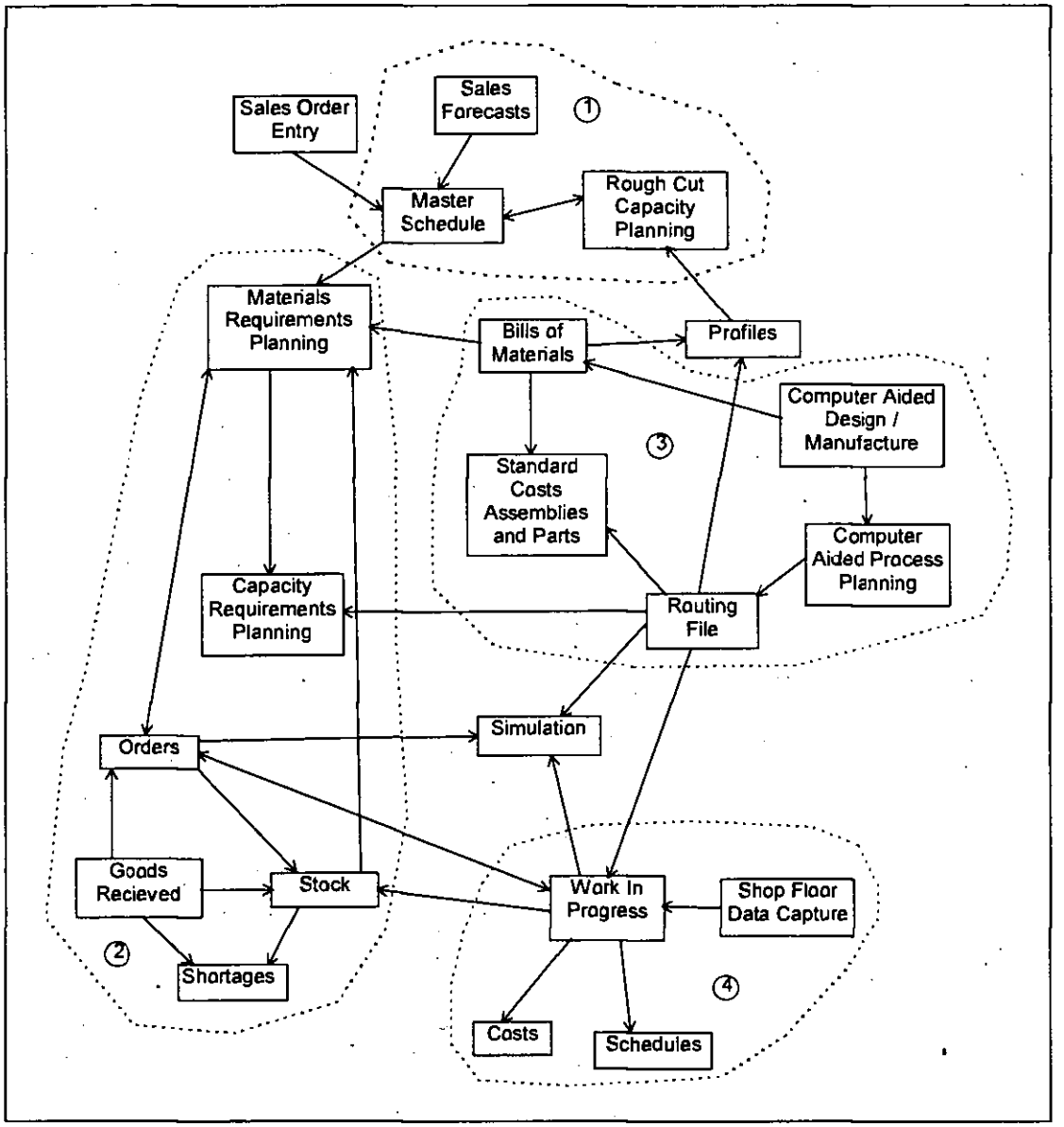

Figure 25 - Diagram of a typical MRPII system structure (D. Corke)

Various sections of the structure have been grouped. These are discussed in terms of whether or not they are system requirements to meet TSI's needs both as a business and in production terms.

Successful production management systems involve many aspects of the modern factory. The numbers in the diagram correspond with the following areas

1. Capacity Planning and Forecasting Demand
2. Materials Management

3. Design and Machine routings
4. Shop Floor Information

The above issues are addressed with respect to the operating structure within Tony Stone Images.

1. Capacity Planning and Forecasting Demand

Starr (6) discusses the capacity decision as a crucial management responsibility. It sets in motion a scenario for startup and growth which is difficult to alter. Downsizing is demoralising and costly. The last-minute realisation of the need for greater capacity is fraught with difficulties and buys the additional volume at a higher price than would have been incurred from original planning stages.

It seems that within TSI, only the departments with a batch process can manage their capacity requirements. These departments are the darkrooms, and the framing and finishing departments. The others attempted to work towards turning work around in a certain time frame depending upon the priority given to the image.

As TSI operates in a similar way to a library; instead of lending books, TSI lends a company the rights to use an image; it is not known from day to day which kinds of images clients are going to request. It is very difficult therefore to forecast sales as although market research can be carried out into the types of images currently in demand, the physical sale of images cannot be quantified.

It is unlikely that either of these two modules in a MRPII system will satisfy the needs of Tony Stone Images in the short term to answer the questions in previous sections or in the long term for development.

2. Materials Management

TSI is essentially a 'make to stock' organisation, however the difficulty then arises when managing stock levels which fluctuate depending upon the images

being borrowed. Every image that is sold is effectively 'on loan' to the client for the period that a licence has been granted. Once that period is over, the image returns to stock. It may or may not go out to another client.

The problem that TSI has is that when an image is duplicated, its sales cannot be forecast and so it may result in either too few or too many copies of an image being available. Where an image is very popular and a shortage occurs, the process of reduping an image takes such a long time depending upon the demand on the rest of production that when the redupes are available the need for the image may have dropped off, causing a glut of unwanted images.

Standard stock policies like safety stocks and order lead times could not be used to monitor finished goods stock levels, however other consumable items which go into making the finished image (frames, sleeves, labels and bar-codes) could benefit from better control.

3. Design and Machine routings

Every TSI product is the same in terms of the materials used and every product has the same routing through the processes. Some decisions have to be made in the darkrooms over which camera to put a job on as it is dictated by the size of the original, but the rest of the process is very straight forward.

More standard manufacturing industries spend a lot of time analysing the best routing through the factory for each product. They are also often dealing with more than one product line at one time and keeping the factory balanced whilst maintaining throughput of each product line. This is not something which is of concern to TSI.

Complicated systems to deal with product design and manufacturing routing issues will not be required by TSI.

4. Shop Floor Information

This is one area where TSI desperately needs to improve immediately to have any chance of understanding the business' current status in preparation for any growth.

The levels of Work In Progress (WIP) as already seen are very high throughout the business. More detail about the WIP is however not known.

- Are there any particular types of images causing delays?
- What is holding production up?
- Where are the main holdups / bottlenecks?
- Are there points where large amount of work all converge at the same time?
- Could the workforce be utilised more effectively?

The other issue is the costs incurred with the high levels of WIP.

- How does the cost of producing 3 catalogues per year balance with the cost of holding images in one department for 14 months?
- Which is more cost effective, more outworkers or a framing machine?

Until more cost information about the process could be known, the answers to these and other questions (which if answered could help the business strategically) can only be guessed at.

In conclusion to this section, an off the shelf MRPII type package will be too complex for TSI as too many of the functions of the business would not benefit from MRPII type control. A bespoke system needs to be written.

5.4 The Formation of a Manufacturing Systems Strategy

In order to create a manufacturing systems strategy, a vision is required. Without one, actions and plans could be implemented which have no direction. A vision links employees to a shared understanding of where the company wants to be in the future. It should match the business objectives, directions

and priorities. It can be seen as the root of common overall understanding of the business which is needed to move the current business forward.

The following matrix taken from the 1993 CIM Institute group project for Royal Mail Midlands (15) shows the dangers associated with visions and plans.

	No Plans	**Plans**
Vision	**Dreaming** Our business will suffer before we get our new systems if we continue like this.	**Success** Now we are aware of the business opportunities open to us, we can ensure that we address the key ones before our competitors do.
No Vision	**Nightmare** It would appear as though it is only a matter of time before disaster strikes .....our systems cannot take the load and we would not survive if we lost them.	**Sleepwalking** Our projects seem to be well planned but we are not sure where they are taking us. Are we wasting time and money? We are not sure.....

Figure 26 - Visions and Plans matrix, The CIM Institute.

TSI currently appear to be sitting in the top left hand box. They have a vision in terms of the way they would like the business to run but have no real plans of how to make that vision a reality. The importance of creating a manufacturing systems strategy for Tony Stone Images is to move them into the top right hand box, giving the company a vision and a planned approach to achieving the mission, or the business plan objectives as discussed in section 4.8.

There is no shortage of technology or knowledge in the company in terms of what modern systems can offer. Indeed the company has made some large investments of their own in terms of opening an electronic imaging facility which offers the opportunity to create specialist images otherwise unobtainable through a camera lens. The problem seems to be that systems which would help the business internally, and are not seen by the client, have taken a back

seat. The main driver in the company is achieving the production of that one image which will sell many many times around the world and reinforce the name of the business.

There is little understanding that no matter how good the company appears to the client, if the internal structure begins to fail, sooner or later the client will notice a poorer service and thus in the long term, business will be lost.

The improvements made to various processes by the PMG and PIG meetings need to be coupled with technology in terms of a system that can carry the business forward.

Quinn and Baily (17) wrote:
'If you don't re-engineer the workflow to take advantage of the technology, you are just doing the same inappropriate things quicker. The most important savings often come from thinking about new relationships between previously separated functions.'

Attempts have been made to unite the decision making processes within TSI and although no new procedures were implemented a certain awareness amongst the individuals involved has been gained.

The main issue now for TSI is to get access to the large amounts of information which will provide the company with the ability to make crucial decisions about the future. It has been clarified that an off the shelf package will not satisfy TSI's needs and is too complex for the process in question.

The answers to many of the questions already posed in this chapter can be found if the company has adequate information gathered along the manufacturing route. The decision has therefore been made to develop and implement a system which purely tracks images through the production process. Information will be gathered about processing times, queue sizes,

waiting times, department resourcing and bottlenecks (by analysing the lateness of orders).

In section 5.3 the basic functionality of a typical MRPII system was compared to TSI's needs. Out of the four main categories only shop floor information is totally applicable to TSI. The system to be developed for TSI which will track images is essentially a form of shop floor data capture and has become known as the Workflow System. It is based on the following functions:

Activities - Where a process is being performed to a submission or image.

Queues - Where submissions and images are waiting to move on to the next activity.

The system will essentially map the current status of the process. Arguments exist over whether the system should be implemented before or after process improvements have been made. In the case of TSI, some improvements have already been made but information is required in order to be able to carry out further improvements. The implementation of the Workflow system will provide information about the manufacturing process which has not been previously known and will either reinforce intended improvements or highlight new areas where improvements can be made.

The Workflow system will eventually replace the following systems:

- Submission Tracking system
- The Creative System
- Production Control Spreadsheets
- Darkroom and Processing spreadsheets
- The outworkers spreadsheets

The only system which will be remaining integrated with the Workflow system is ICATS. The diagram at the beginning of the chapter (Fig 21) showing the

systems supporting the production process at Tony Stone Images can be changed and will be as follows:

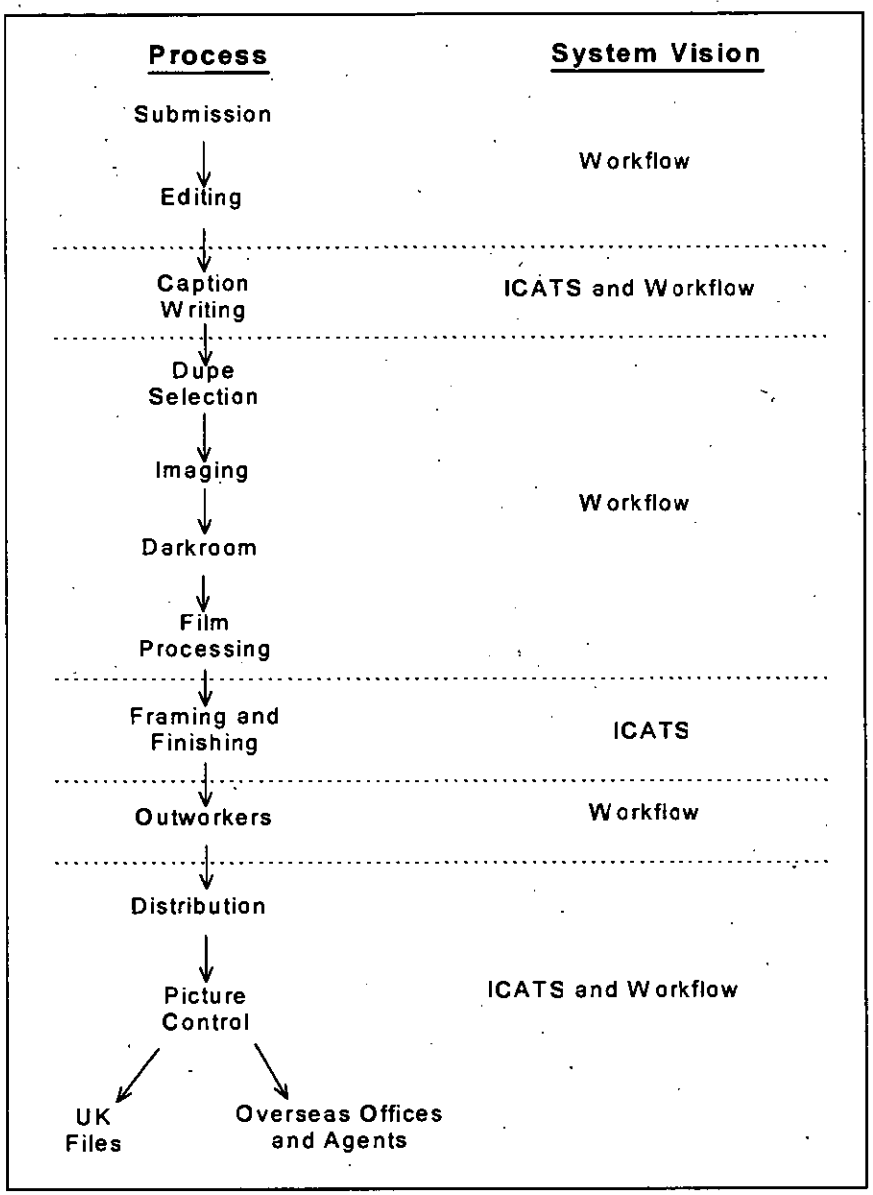

Figure 27 - Diagram showing how systems supporting the production process would change due to implementation of the Workflow System

The ultimate goal is to replace ICATS and expand the Workflow system to support all of the business needs.

Due to the scale of the project it has been decided to break the system development down into two phases. From the analysis carried out thus far, the processes which need the most monitoring are those areas encompassing decision making about the profitability of an image to the company. Once

images are in the darkrooms the process still needs monitoring but as it is more linear and is not open to as many loopholes it was not deemed to be as critical.

Phase 1

- Submission Entry
- Editing
- Bar-Coding / Framing / Caption Writing
- Dupe Selection

Phase 2

- Electronic Imaging
- Duping
- Framing and Finishing
- Distribution

Phase two is also planned to encompass raw material stock control of consumable items needed to finish a duplicate (sleeves, frames, labels, bar-codes). It is also planned to begin looking at machine capacities and job loading in tangible areas such as the darkrooms.

Quinn and Baily also found that companies who broke down system development into smaller areas found that their projects were more manageable and more likely to succeed.

At this point, two phases seemed reasonable for Tony Stone Images, however nothing was to say that it could not be broken down further at a later date.

The remainder of this thesis deals with the development and implementation of phase 1.

6. Development of the Workflow System

Having decided upon the system to be implemented, the structure of the system; including a specification and project plan documentation; needed to be established. This also included the installation and training of the system with the users.

6.1 The Structure of the Workflow System

Browne (10) suggested that applications must be portable across various computer platforms. Portability implies that application software developed on a given hardware or operating system platform can easily be transported to another platform if desired. This required the use of standard programming syntax language as well as standard calls to the Operating System.

The platforms present at Tony Stone Images were as follows:

ICATS - Oracle Based
TSLIB (Tony Stone Library - the old library system) - Hewlett Packard 3000
Stand alone systems - SQL and Visual Basic

The decision for which platform should be used by the Workflow system was made by members of Tony Stone Images' own internal systems department. The system chosen was Visual Basic with data tables which could be read by both ICATS and the Workflow System. This will lend itself to single data entry accessible by both systems.

Visual Basic will allow the Workflow System to be flexible and portable such that as ICATS is implemented in the overseas offices, the Workflow System can be implemented in all offices which have an Editing and Image Classification function to complete, prior to images being sent to London for processing.

This will be key in the development of Tony Stone Images, for as the company grows, either production at the London office will have to become much more

responsive, or the question of having other production units around the world needs to be raised. One of these locations will have to be in America as the American market represents approximately 40% of Tony Stone Images overall business.

As already briefly discussed, the Workflow system was designed to operate on a queues and activities structure. This will be most useful to the organisation as more emphasis can be placed on the size of the queues through gaining more visibility across all of the departments.

Initially the Workflow system was to have the following structure.

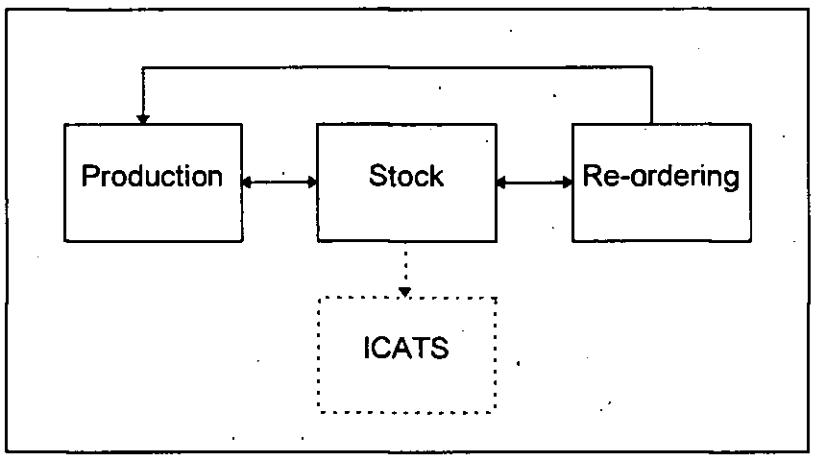

Figure 28 - The original Workflow System structure

Production: This covered the already discussed concept of queues and activities to give visibility to work and allow information to be gathered.

Stock: Finished goods stock, i.e. images in the library to sell, and raw materials stock (film, framing materials etc.) Ultimately this would involve the setting up of order quantities and stock levels within the system depending upon usage.

Re-Ordering: The re-ordering of sets of images already being sold. This process is also known as re-duping.

The dotted line connecting to ICATS is part of the system structure to show that information is collected from and provided to ICATS at various points in the Workflow system to maintain a database common to both systems.

The decision was then made to develop the Workflow system in two phases. Phase 1 covers the Creative end of the business as discussed in Chapter 5.

- Submission Entry
- Editing
- Bar-coding, Framing, Caption Writing
- Dupe Selection

Figure 28 can therefore be re-drawn showing the structure of the Workflow System and the corresponding phases in which it is to be developed.

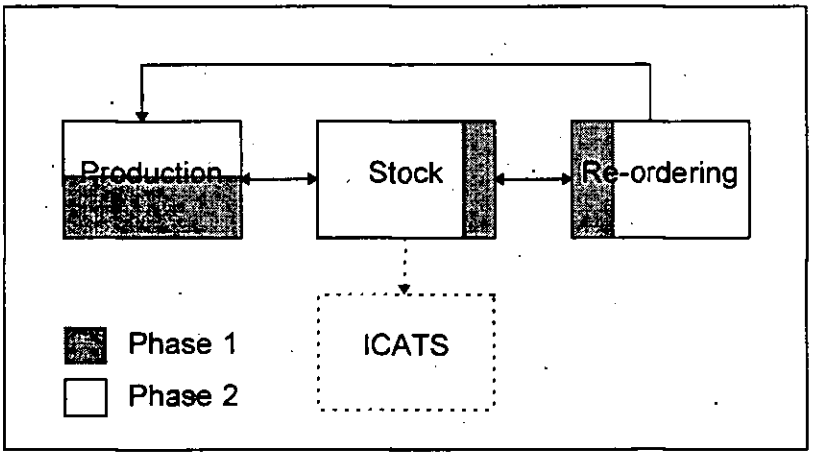

Figure 29 - Modified Workflow System structure showing the two phases of development

Only half of the production section is covered due to the decision to create the Workflow system in 2 phases. Perhaps the section under question in phase 1 is that of reordering. This is only half covered as although stocks are managed later in the process, the act of raising a re-dupe impacts on the capacity available in the darkrooms for new dupes and the amount of first time work which can be put through from Creative. A balance has to be struck between getting new images duped for worldwide distribution and keeping stocks of

existing material high enough to satisfy demand. Allowances have to be made for phase two during the development of phase 1.

6.2 Developing a Technical Specification

The theory for developing a technical specification was generally followed from Farrell and Broude (18).

The first stage carried out is referred to as 'Informal Contract' and includes the following issues:

1. Spend time looking for problems in the early phases - so you don't have to spend twice the time solving them later.
2. Meet the key clients individually to learn their needs and concerns before getting them all together in a meeting.
3. Use the informal contract phase to build relationships of open communication and mutual trust.
4. Be specific in asking for the support you need from your clients, and get firm commitments.

These points should be relatively simple to achieve due to the amount of work that has been done previously through the PMG and PIG. It was felt that good relationships had been established and although more detailed questions needed to be asked, an understanding of the processes had already been gained. The second stage is known as needs analysis and covers:

1. Observation of the users functions to determine how the new system will handle various transactions.
2. Talking to the users in their own language and in terms of their own experience.
3. Creating a vision to pull the users to the new system.
4. Pushing users away from the old system by asking what they don't like about it.

The final point proves to be very significant, especially for the users of the ICATS system which was only just a year old at this stage. The main frustration for nearly all concerned has turned out to be the issue of information sharing. A lot of time is taken up with many people searching for the answers to the smallest queries which should be available from a system enquiry screen. The solving of these and other problems in less time has become the selling point for the new system.

A technical specification detailing each intended section of the system and its relevant inputs and outputs was produced by the systems department in the autumn of 1994. A period of acceptance and sign off for the specification was entered into. Various parts of the specification were changed and eventually sign off was achieved from the users in order to permit the systems department to proceed with the coding of the system and the design of the screens.

The decision was made early in the system specification to involve only the managers and supervisors of each section in the development. This may or may not have been the correct decision to make but the reasoning at the time was as follows:

Those working the closest to the product i.e. the editors, caption writers etc. were happy to let the images dictate the pace at which the company moved forward. Although it was appreciated that the business was growing, the idea of putting controls over a process that is creative whose results are rarely the same twice could not be grasped. It was felt that a lot of time would be spent trying to reach consensus with very little value being added. As a result a decision was made by a fair representation of the user and the process to be documented to commence on a manager / supervisor level, bringing in all users at a later date.

6.3 The development cycle.

The following diagrams represent the development process which was taken in order to produce the Workflow system. This is taken from a set of notes on

Software Engineering made by Aamir Matin (19) from the CIM Institute at Cranfield University.

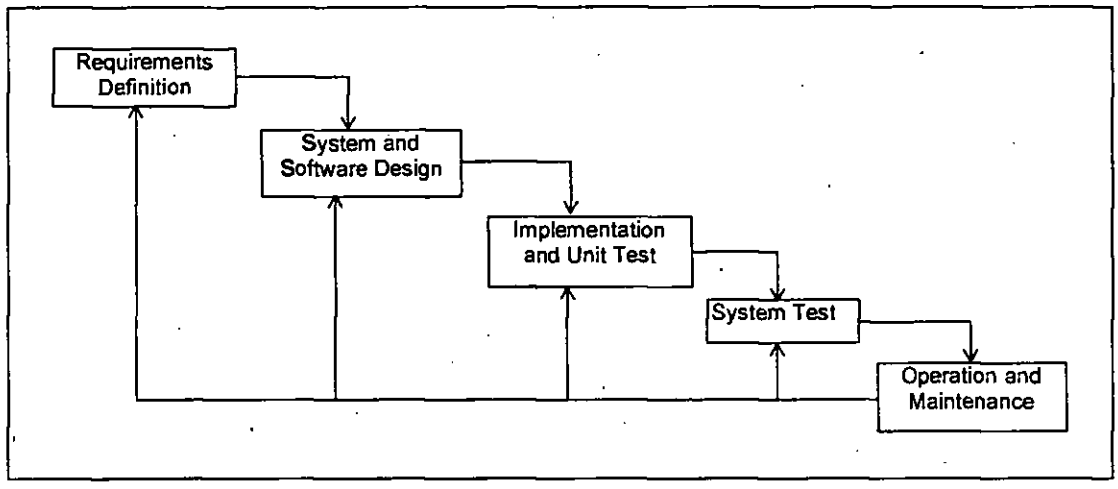

Figure 30 - The waterfall model of system development

The waterfall model has been in use for system development for a long time and covers the issues of defining the system and the design testing and implementation stages. The final stage is the operation and maintenance stage which is linked back up to all of the other stages showing that systems development is an iterative process and at any stage in the development, any of the other stages can be revisited and may impact on the final specification.

Matin has since replaced the waterfall method in his own work by the process shown in figure 31 which is seen to more accurately represent the reality of software development.

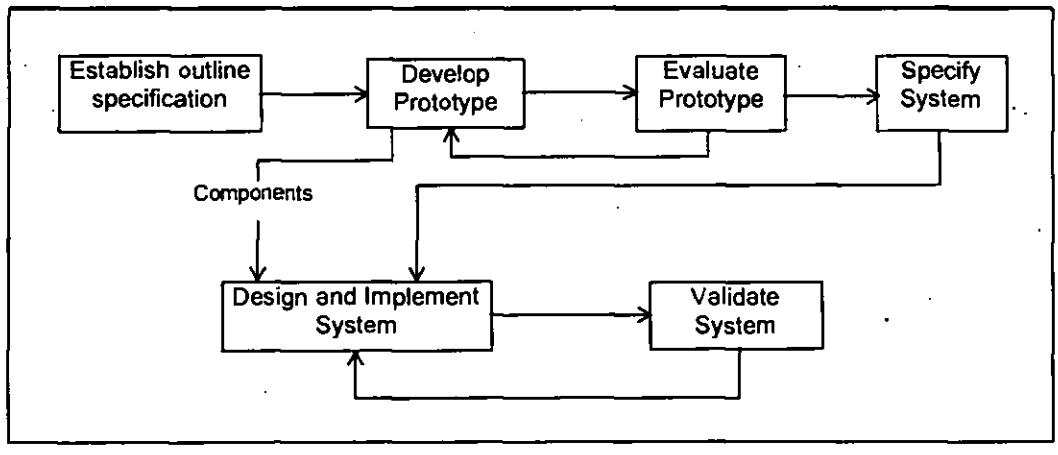

Figure 31 - New software engineering flowchart as used by Matin

There are many loops in the design of a system all of which involve feedback to ensure that all of the requirements have been met and are achievable.
Many operations also occur at the same time. As part of finalising the technical specification, a prototype Workflow system was built mainly for two reasons.

1. To allow the software engineer to evaluate the feasibility of the requirements.

2. To provide the users with a sample product promoting the generation of ideas at an early stage in the process. This meets point 1 of the 'Informal Contract' by Farrell and Broude (18) - Spend time looking for problems in the early phase - so you don't have to spend twice the time solving them later.

A prototype system was written by the systems department and proved to be very successful in helping to generate. It also provided a visual sample of the system to the users. The prototype proved that departments really could get the information they wanted and in many cases provided information which would be useful to have and had not previously been recognised.

Matin details the goals of software engineering as follows:

1. Low cost of production.
2. High Performance.
3. Portability (already detailed by Browne (10)).
4. Low cost of maintenance.
5. High Reliability.
6. Delivery on time.

These goals are also the source of many problems and it is paramount for TSI to avoid / overcome as many problems as possible to maintain faith in the system, especially as the prototype exceeded expectations. The route that development then took was:

1. The systems department produced the system in modules which were designed to follow the flow of work through production.

2. The modules were then tested. Any problems or bugs which were discovered were reported back to the systems department to be removed and any amendments were made where necessary.

3. The user documentation was produced and proof read by the systems department. Again any changes and amendments were made where necessary.

4. The modules were implemented in parallel to the old stand alone systems.

5. Integration with ICATS and other modules was eventually be established and old the systems were removed.

6. The full implementation of phase 1 was complete.

6.4 Changes to the Specification

Although a lot of work was done to capture every eventuality that the system would have to handle, a change to the specification was required which was not identified until the module was implemented.

The change was to the booking-in and editing module and specifically involved the booking-in and editing of submissions from the overseas offices in France, Belgium, Holland and Germany.

Although editing guidelines had been set by the creative department in London, the quality of the images being sent through for duplicating from Europe were not meeting the standards produced by the UK editors. As a result, any submissions arriving from Europe had to be edited for a second time.

There were however submissions which arrived from America to be entered into duplication which did not require second editing. The offices in America were operating the ICATS system and information about the images was sent to London by a process known as AIT (Automatic Image Transfer). For any images sent via AIT, the editing and image classification route was omitted and images were entered directly into dupe selection.

The submitting offices in Europe had an ICATS installation but at the time did not have the facility to perform AIT transactions. As the following diagram shows, Tony Stone Images had to deal with images coming from overseas in three ways.

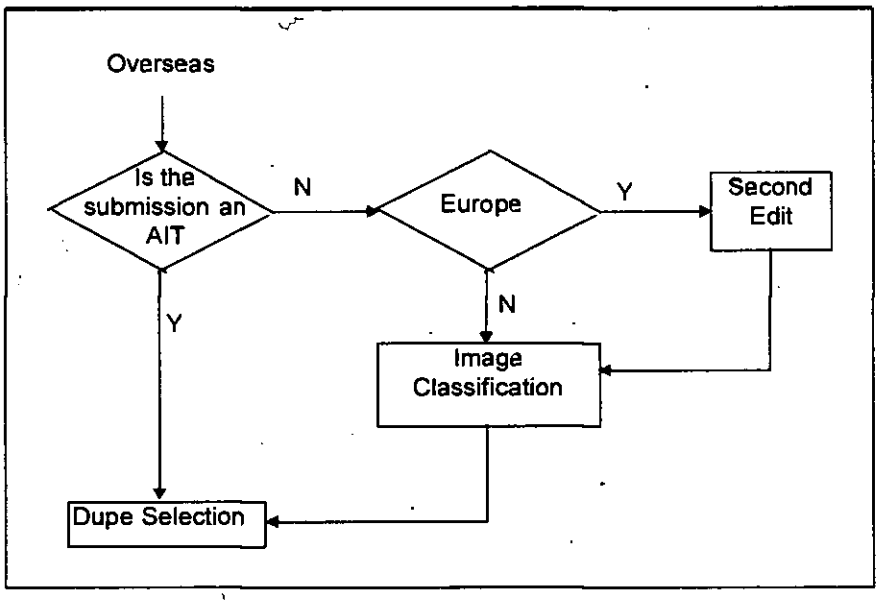

Figure 32 - Different routes for overseas images into editing and dupe selection

The third area was where offices in America did not have access to send image information by AIT but whose images did not need second editing. In this case the images went from entry to Image Classification for captioning / numbering and then onto dupe selection.

The system had been written on the understanding that every overseas image being booked in as AIT or Non-AIT would always by-pass editing. The problem was only discovered when the Creative Coordinator booked a submission in from Belgium and tried to route it through editing. There was not a function in the system to accommodate this operation at the time and a system change

form had to be filled in and passed to the systems department in order for the changes to be made to both the system and the specification.

Time was also lost where changes had to be made to the specification to create a new section for selecting images for the catalogue. Images to be part of the catalogue are selected from subject categories and routed through the publications department for various administration and print setting tasks before going on to production in the usual way.

6.5 Basic System Functionality

The Workflow system was built on the theory of making the priority of an image as it enters and travels through the system as visible as possible to all departments. This visibility has to be both physical; i.e. when the image is on a desk, as well as electronic; when the image is being queried in the system.

In some departments, various coding systems had been used to identify images but only when in that department. There was no common system to the whole company allowing communication across departments on image priority. As a result, a colour coding system was developed giving images different colours depending upon their priority. Colours are assigned to images as follows:

Emergency - red
High - blue
Normal - green

The priority assigned to an image depends upon the time remaining for the image to be in dupe selection from the point of entry. In order to get to dupe selection, images have to pass through two main departments and the processing time allocated to each has to be equal. Priorities and time frames are detailed in the following table.

	Edit	Caption	Total
Red (Emergency)	1 hour ↓ 2.5 days	1 hour ↓ 2.5 days	2 hours ↓ 5 days
Blue (High)	3 days ↓ 10 days	3 days ↓ 10 days	6 days ↓ 20 days
Green (Normal)	10 days ↓ 20 days	10 days ↓ 20 days	20 days ↓ 40 days

Figure 33 - Table showing the number of processing days available to Creative and Image Classification

As a result of colour coding images to show their priorities, the following changes have been implemented in Creative, Image Classification and Dupe Selection.

6.5.1 Creative - Booking in

Images are assigned a priority on the system which automatically colour codes the appropriate record on the Workflow system screen. A corresponding coloured sticker is attached to the image bag making image priority visible for those unable to query the record on the system to check. The image is at this time also assigned to an editor. The record then becomes visible on the editor's screen showing that the job needs progressing.

6.5.2 Creative - Editing

Each editor has a specific sign on which relates to the work assigned to them for editing. By opening up the queue screen for pending editing work, the critical images can be seen instantly by their colour code. Once an image goes late in editing against the colour priority it is set (relating to the time the image should spend in the department in order for it to arrive at Dupe Selection on time) the record flashes on the queue screen. This is a further indication to the editor of the urgency of dealing with the image.

The editors also use the racking system for organising work (as discussed in section 4.2) and use 'held' boxes. Two classifications for 'held' work were implemented as a result of the Workflow system. The short term hold is for

situations where the editor knows a problem with an image that can be solved in a few days. e.g. model releases and caption information are being sent separately and the image goes on hold to wait for the accompanying documentation to arrive. The long term 'held' applies to problems with images that can not be resolved as the photographer is not contactable perhaps due to being on location on another shoot. The image is put on hold and is moved to the 'held' queue on the Workflow system which is monitored to make sure image queries are being dealt with by the editors.

Those with supervisory sign ons for the system can view all of the editors screens to monitor editor progress and target any problems which may occur due to workload on any one particular editor being more than another.

6.5.3 Image Classification

Any images entering Image Classification late from editing do not penalise the time available to Image Classification for processing. In the past Image Classification would have worked twice as fast to make up for any delays in Creative. This has been eliminated as the Workflow system shows where images are going late so that the problem can be dealt with at source, allowing Creative to become more proactive rather than make Image Classification reactive. Images arriving late show on the Workflow system queue screen with the letter 'L' next to the record letting Image Classification know how much work is coming through late, and if there is time, to give the 'L' images priority over others, without making others late.

A series of coloured boxes relating to each colour priority were arranged on new shelving in the Image Classification department. Each image coming through from editing is placed in the correct box for its priority. The boxes for emergency priority (red) are a lot smaller than the blue or green boxes as there should be fewer images of this status. Images which are to be made emergency priority have to be agreed at supervisory level otherwise the red priority could be abused and the overall priority system to manage workload

would not work. The possibility of all images becoming red priority during a busy period has to be avoided.

As with editing, the Image Classification queue screen shows jobs waiting in their colour band which flashes as late if the processing time matching that priority has been exceeded. The supervisory sign on for Image Classification also allows viewing of the editor queue screens so that the amount of work coming through from editing can be anticipated and resourcing within the Image Classification department changed accordingly.

6.5.4 Dupe Selection

All images arriving at Dupe Selection should be on time allowing greater selection from the subject matter available.

Cupboards for UK submitted images, US submitted images and other submission sources have been set up accordingly with small boxes for each subject category. Images are instantly more visible and quantities selected to meet marketing targets can be more accurately recorded (percentage breakdown of images sent for Duping submitted by the UK, US and other).

As each image is selected, the transactions are recorded on the Dupe Selection section of the Workflow system for further image processing (Duping or Electronic Imaging). The decision made at this point sets the priority for images moving into phase 2 of the Workflow system.

Image tracking within the Workflow system ends at Dupe Selection for phase 1 however full history of the image movement to this point is available on the query screens within the system and the ending department (Dupe Selection) has been left such that it will be easy to transfer image data into the second phase screens.

6.6 Method of Implementation

By the time a substantial amount of the system had been developed and tested, a plan was put into action for the installation of the Workflow System.

6.6.1 Hardware

As part of the ongoing systems development throughout the company, there was a policy in place to update the PCs in the departments involved in the Workflow System project.

The first task of the implementation was to upgrade the existing PCs to ones which would successfully run the Workflow System and would also be flexible enough for future software installations. The PC specification for Creative and Image Classification was as follows:

- 486 processor
- 12 Mb RAM
- 420 Mb Hard Drive
- 3.5" floppy drive
- CD ROM
- 66 MHz clock speed

CD ROM facility was only installed in Image Classification for the use of encyclopedia CDs to help with caption writing.

6.6.2 The Workflow System Modules

The Workflow system modules were implemented as testing was completed. The most important element of the installation has been acceptance by the users. Up until this stage, users had been kept informed of the development of the system and the functionality it would have. Installation was the first time users had seen the system.

Returning to Farrell and Broude's methodology, the acceptance phase details the following points.

1. Give your pilot group everything you've got. Make them winners at all costs.
2. Always remember you are helping people by succeeding in your implementation.

3. Keep the vision alive for your users.
4. Use a demo system to show users results quickly.
5. Reinforce and acknowledge people constantly, even for small successes.
6. New systems can cause social disruptions. Create a way to replace old relationships and reinforce new values.
7. Be sure to thank your pilot group and critical mass participants for their extra efforts.

At Tony Stone Images the pilot group was made up of the supervisors and managers who had initially agreed and signed-off the technical specification for the programming to begin. There were also staff representatives in each department which were used to sell the system to the remaining users.

Each module within phase 1 was successfully implemented as follows:

- Creative (1) - Submission booking in and editing. Parallel running on the 21st February, live on 13th / 14th March 1995.
- Image Classification - Submission bar-coding, Framing and Caption Writing. Live on 6th March 1995, fully in use from 20th March.
- Creative (2) - Dupe selection functions. Live on 11th April 1995.
- Catalogue Selection - Live Mid May 1995.
- Query, Queuing and Maintenance Screens - Live on 22nd May 1995.

The completion of the query, queuing and maintenance screens was vital to allow information to be retrieved from the system. These were mainly query screens covering the current status of the images thus far in the system. A lot of information suddenly became available to many people throughout the organisation.

6.6.3 Training

It was felt that the system would be better received if the training for each module was carried out by an individual who understood the process. They

could then relate to everyday issues which could arise and cover how the system would help to resolve them.

There were also issues which could arise without knowing whether or not the system could be of any assistance. Scenario training was given on these occasions mainly on making use of the query facilities.

The system developer and tester took it in turns to train a key individual in the relevant department into which a module was to be installed. The key individual then down-trained the other users in the department. Training was largely one to one or one to two small group sessions.

All of the departments receiving new modules completed the training in the week previous to the go live dates detailed in Section 6.5.2.

6.6.4 The User Manual.

As a guide to the users for answering any questions on situations occurring less frequently than normal operations, or for reference, a user manual was written.

As each module of the system was released, corresponding versions of the user manual were also released. Comments were made by users over how friendly they felt the manual was and any changes were made as necessary.

A full paper version of the user manual was released to each user on the 21st of June. The manual has been held electronically as it is intended to be formatted for on line help from the system.

Sample screens from the Creative and Image Classification modules of the Workflow System can be seen in Appendix F.

7. Success, Failure and Learning from the Teaching Company Scheme

In order to look at the successes, failures and learning of Tony Stone Images as a result of the project, it is necessary to summarise the overall learning and development process through which the company has gone.

Dr. Victor Newman (20) uses a methodology known as the Learning Team Approach (LTA) to tackle problem solving. The following diagram shows the Problem Solving Process (PSP) wheel.

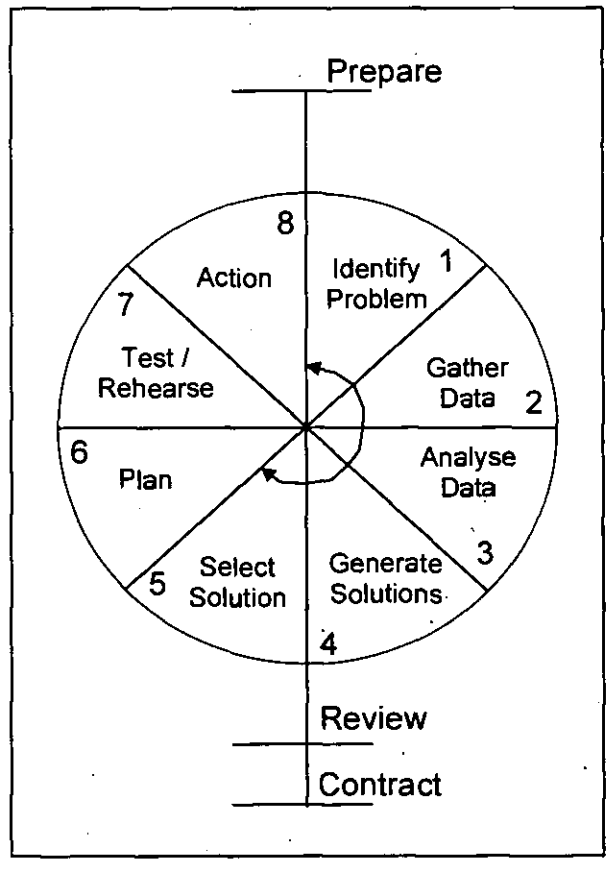

Figure 34 - The Problem Solving Process Wheel

Starting at stage 1 on the wheel, the course of the work carried out can be mapped as follows:-

Identify the Problem

This was the stage at which Tony Stone Images understood where they were in their field of business and where they wanted to be in terms of their position

with competitors in the market. A manufacturing strategy had to be defined and within that a production planning and control system was required. Tony Stone Images initially came to Middlesex University when it became clear that the knowledge base they required to overcome the problem of increased volumes and demand for images was not available internally.

Gather Data

Once work began on defining the larger problem and more information about the company was gathered, smaller problems were defined which were then broken down into more manageable areas.

- Lack of knowledge on the current production lead time
- Lack of image tracking / recording
- Poor departmental organisation to best fit the flow of the process
- Inefficient communications between departments
- Labour intensive and costly manual processes
- Reactive rather than proactive production environment

The data to back the above statements was collected through the use of the flowcharts, critical path analysis and job tracking forms as discussed in chapter 3. This all provided the grounds upon which the solutions were generated.

Analyse Data

Analysis of the data provided a means to define particular areas that could be acted upon. The most evident issue was that the company did not know how many images were going through the production process at any one time, where the images were and how long they had been on the premises as work in progress. Whilst an image is in processing it cannot be sold and therefore cannot make any money. Other issues which came to light were that the departments were not organised to best fit the flow of work through the building or the process, and the individual departments were not structured internally in a way which would allow good management of the work load at each location.

Generate and Select Solutions

Chapter 4 details the improvement projects that were identified and carried out within Tony Stone Images. Some projects were smaller than others and the most important issue which came to light was the need for an integrated production management system which linked with the already successful library and sales system - ICATS.

At this point on the PSP wheel an arrow returns to stage 1 (identify the problem). This shows that within the wheel there is an iterative process whereby solutions may not prove to be ideal so that the problem needs to be revisited, or the solutions which are to be implemented have within them smaller groups of problems which need to be resolved in the same way. The decision to return to stage 1, brought about through the 'Review' stalk coming from the bottom of the wheel.

A good example of this is after having identified the need for the production management system, problems such as how to define the system to suit the business and the user needed to be overcome. Without realising it, the iterative process of the PSP wheel would probably have been gone through many many times. Some would have been in a day where smaller issues were resolved, others will have taken weeks to reach a consensus on more complicated problems which were harder to crack and probably needed the skill and involvement of individuals other than those directly involved in the project.

Once a solution is agreed, the project takes on the Contract stalk from the wheel and moves on to solve the initial problem by implementing the agreed solution.

Plan, Test and Rehearse

These stages were the development of a prototype Workflow system in which screens were developed, changes in working methods were established and an overall implementation strategy was defined. Structure was put behind each element in terms of the way the 'go live' should be tackled and documentation

was developed by way of a systems requirements specification, a technical specification, user manual and change request forms. This way the progress of the project could be accounted for. Only when the background detailed work had been done and approved did work continue.

Action.

This is the stage where the solution which has been chosen to solve the defined problem is put into practice. As far as the Workflow system is concerned this involved the programming, training and installation phases. Installation not only involves providing users with the system but also making sure each work station PC is of the correct specification to use the system efficiently.

The action phase tends to generate more problems which were not foreseen during the development phases, causing the PSP wheel to be used again. An example of this is point 6.4 where changes were made to the specification once part of the system was in testing ready for installation. This was caused by the different method of booking in overseas images depending upon their originating office.

Resulting from the LTA and using the PSP wheel a need for feedback is generated. This takes on board areas of learning from the project and areas which went well whilst others did not. The process of listing success and failure or 'celebrating' the good and the bad shows that all experiences have value and can be used as learning points in future situations of a similar nature.

The successes and failures experienced both personally and by Tony Stone Images are detailed in the next two sections.

7.1 Successes

Although it is usually preferred that success is measurable, many of the successes resulting from the various projects tackled within the programme are

not. The greatest teller is a noticeable change in the atmosphere within Tony Stone Images. These successes detail that change.

7.1.1 The Workflow System

An overriding success is the gain of consistent information between the different processes of the production cycle. It has provided a great deal of visibility within the current manufacturing process and also highlights areas where change can occur in the future. The visibility of workload has made the management of staff levels easier.

Some true history about the images is available which will in time give more information about the process and areas where some images move more quickly than others. The figures produced by the Workflow System are believable and used by many in detailing the progress and achievements of their departments.

Forward planning has been helped in many ways. The supervisors of each section have access to the queue screens of the preceding operations. This allows vision not only of the volume of work emerging but also the subject areas that work is falling into. This has proved to be particularly useful during catalogue production.

7.1.2 The Company

Tony Stone Images has been given an insight into the basic principles of manufacturing and how they can be applied to arts based environments. The major success has been providing departments with enough understanding of the process which they form part of, to question it and make improvements.

A key piece of information for the company to take into consideration for future development is that there is not a set lead time for an image to be filed as a duplicate. The processing time is dependent upon the speed with which decisions can be made in the Creative department. This has not yet been controlled as either part of the Workflow System or as standard business

practice. In order to fully adopt manufacturing theories, a change in business policy over the decision on images may have to be made. When the company was handling smaller volumes of images, the time spent on making a decision about an image was not as crucial as it is now in terms of making the image available to the market. This has to be realised and dealt with.

A benefit to the company which supports the philosophy has also been the ability to have an individual dedicated to projects and improvement work to provide an external viewpoint on the process and production issues.

7.2 Failure

Failure is used in this context to represent issues and situations involving either the company or the project which could have been handled differently.

7.2.1 The Worklflow System

The biggest disappointment was that for all the hard work and effort which went in to obtaining the correct specification for the system, some areas and issues were still overlooked.

The upshot of this points at the teamwork involved and the ownership of the system. Resourcing was quite poor in some areas in terms of individuals being available to the project when their time was asked for. This raises the question of how easy / difficult it is to remain in an active role in the day to day running of a department and be involved in a large systems project.

As a result of the teamwork and resourcing issue, it was difficult in some cases to encourage the 'buying in' to the system by each department to aid successful implementation. System ownership was not fully obtained for each module as it was implemented in the different departments. This problem will ultimately affect correct system usage.

The support and maintenance of the system was extremely good, however as the system was implemented in modules, conflict arose between supporting

that which had gone live and developing new modules. The difficulty then became making the decision as to which area is the priority.

The system has been implemented up to the electronic imaging and duping stages of the process. The remainder is to become phase 2. As already mentioned, the areas of production to be covered by phase 2 are more linear in structure than phase 1 and so are not seen to be as difficult to control. As a result, the continued development and installation of the Workflow System has taken second place to the development of a marketing database. The main problem with this decision is that although better information is available in some areas of production it does not yet cover the whole process. The company finds itself in a similar position as before, i.e. many decentralised, non integrated systems are in use and it is still not fully known how long the average production lead time is for the different types of image produced. The reasons for this were discussed in section 7.1.2.

As data cannot yet be gathered on the whole process, cycles and trends cannot totally be predicted. Although vast improvements have been made, many decisions about the business and its processes still remain reactive rather than proactive.

7.3 Learning

Tony Stone Images has learned a great deal throughout the course of the project and it is difficult to pin point the events which have brought about this enrichment of knowledge.

The main objective in developing the Workflow System has been to make sure that it was right, not only for the business in making images more visible but also for the users to capture the data required. In order to use the system fully they had to feel happy about its functionality and purpose. A consensus on the structure of the system was reached through many meetings with many individuals which brought about a lot of participation in the decisions which were made.

Chapman, Cooper and Page (21) discuss improvement in performance through involving the participation of employees in decision making at various levels. Employees are given the opportunity to have some input into managerial decision making and to have their views influence decisions that are made without having the responsibility or authority to carry the decision through.

Lawler (22) wrote that more widespread participation in management decision making will be facilitated where:

1. Employees are trained in the necessary interpersonal skills and educated about economic aspects of the business.
2. The information necessary for meaningful participation is available.
3. Employees work in groups or teams providing cross-training and job rotation which give them a wider understanding of organisational activities.
4. There is job security and a sense of commitment to the organisation.
5. There are safe and pleasant working conditions.
6. There is an egalitarian climate in respect of work facilities and status, and pay differentials are minimised.

This line of thinking can be applied to Tony Stone Images as individuals did become involved in the development of the Workflow system and were making decisions about the system that would affect their departments. In doing so, a greater general appreciation of the business was gained by departments which had become increasingly insular. This increased knowledge lead to greater communications between departments and allowed agreement on the overall structure of the system to be attained.

The learning points are a combination of personal learning from the experience of the Teaching Company Programme and that which Tony Stone Images has learned about its operations, practices and potential for the future.

7.3.1 People

The saying; "You can please all of the people some of the time and some of the people all of the time but you can't please all of the people all of the time" rings absolutely true for Tony Stone Images

One of the most difficult aspects of any change be it a system installation or business restructuring is the people that are involved. If people do not show an interest or do not want to be involved in the project then a large amount of effort is wasted. The human element affected the project at Tony Stone Images in many ways.

- Not everyone had the same priorities.
- The important issue / project of the moment would become lost in tomorrow's business pressures.
- It is difficult to see how something will benefit the company long term when short term issues fill everyone's day.
- Changes are seen as a threat to job security and business position.

On the whole, the company realised that the original controls and information capture were not ideal and improvements needed to be made. The difficult part to deal with is that, on the whole, the most influential individuals in business terms are also the ones required to have a large input to the project. To ask for a lot of time from the very people that the business could least do without is and was a very difficult barrier to overcome.

The strongest message to come out of the installation of the Workflow system was that in order for it to be a success, it had to be a team effort. This meant involvement from individuals at all levels whether the system was a priority for them or not. Commitment to the project during development, installation and subsequent ownership of the system and new working practices was eventually achieved. It was however an eye opener for all concerned.

7.3.2 Systems Projects.

No systems project is easy. The most important lesson to be learned from all that was achieved both personally and as a business is that it is imperative to spend the time at the beginning defining the system requirements before moving into development to ensure that time is not wasted later on. As time consuming and often uninteresting as it may often seem, correct system definition is invaluable. System changes are more difficult to make once programming has begun as sections may have to be rewritten and redesigned as a result. In most cases, system changes during development will incur extra costs than originally anticipated to cover time and modification.

Coupled with systems projects is the issue of good communications; understanding exactly what is being proposed. In the case of Tony Stone Images, each department needed a good overall understanding of the business and their position in the production process before any system requirements could be documented. Once the system requirements are documented and agreed by the users, it is vital that the system developers also understand the process to be able to visualise the system in the environment it is to be used. This was largely achieved at Tony Stone Images and the system as it stands so far meets and in some cases exceeds user and management expectations.

8. Conclusions

A lot of the barriers which have arisen in implementing systems and in bringing about change are to do with the human element of the organisation and the culture which develops with it.

The purpose of this thesis was to demonstrate how a two year period of work can change and form an arts based organisation into one which is making use of basic manufacturing techniques in every day tasks to sustain growth in the market and remain competitive.

The biggest issue was managing and controlling the large volume of work in the building to provide those on a higher level with the information required to make strategic decisions. For every image accepted into the library to be sold world-wide, a duplicating, framing, finishing and distribution process had to take place. The library files were being added to at the rate of 200 images a week, out of which some were duplicated, creating on average another 200 copies per image for processing. The problems with the large volumes of work created difficulties with tracking the progress of work and gathering data about the work.

Installation of the Workflow system, albeit only phase one, has already shown great benefits in image traceability. Over a period of time, enough production information will be available to allow management decisions to be made. These may be over the number of submissions accepted in certain subject areas, or the types and size (in terms of number of images) of catalogues produced.

In order to have a full picture of the production process, including product lead time for different image types, it is vital that phase two of the Workflow system goes ahead both in development and installation.

The exercises undertaken to gather information about the duration of each stage of the process and the activities that were involved, highlighted areas where improvements could be made. The changes made to the largely

administrative areas for example Image Classification were welcomed as the new structure allowed greater management of the flow of work. Some changes in the Creative department were not received as easily as it was felt that the controls put in place to manage progressing images through the department were stifling some of the creative flair and freedom the department was used to.

Restrictions in Creative have essentially been self imposed by the organisation increasing the intake of photographer submissions to meet the pressures of growth to increase market share. To remain competitive the numbers of images on offer to a client covering their requested subject area has to be greater and of better quality than those offered by other image libraries. The main competitors such as Image Bank and The Telegraph concentrate so much on wide subject variety that Tony Stone Images has to do the same. The main difference being that competitors produce their images on 35mm film and Tony Stone Images produce theirs on 70mm film. Although more of the image detail can be seen on 70mm film it also makes clients more choosy about the quality of the image. Tony Stone Images found themselves needing to strike a balance between increasing the volume of images in the library to be competitive and maintaining the image quality of the small cottage industry created in 1962 on which the company's reputation was built. To provide the customer with the choice they demand, the volume must be produced in the first place. Producing the volume goes against the grain of the traditional company set up.

It is important for the company to address its policies surrounding production volume versus image quality.

If production volume emerges as the important issue, automation of as much of the process as possible is vital in order to remove value adding tasks and save time. Automation would also facilitate the company's ability to get images to market quickly.

Since carrying out the original study, it is understood that the scope of the automating framing and finishing project has widened to include in-house processing of film. The need for subcontracting work either to an outside

processing house or outworkers would cease. If the duping, processing, framing and finishing sections were to become automated and lineal, efficiency would improve and would allow the company to focus on other problem areas of the business which are difficult to solve.

Tony Stone Images' office in London is the only manufacturing site for image distribution world-wide, taking images for duping from the UK, USA and Europe. Browne (10) suggested that the trend in production systems is towards decentralisation, placing a high demand on distributing the databases, user interfaces and the individual functionality of each application.

Due to the growth of the company throughout the US and Europe, Tony Stone Images may well find in time that it is no longer practical to carry out all of the production functions from London to supply the rest of the world. In the same way Browne feels that systems could be decentralised, Tony Stone Images could decentralise production. The small company image no longer suits business practice at Tony Stone Images and perhaps decentralisation of the production function is an option to be considered.

The company is no longer a small one and has to formulate strategies which match the size of the business and the market in which it operates.

Tony Stone Images has emerged richer in knowledge for going through the process of defining, developing and installing the Workflow system. A lot of background work had to be done and other business changes were made around the peripherals of the Workflow system's direct functionality. The realisation that an arts based and service type industry can use basic manufacturing philosophy effectively has paved the way for future improvements. Tony Stone Images has the foundation to remain competitive in the images library market and must now harness the enthusiasm for improvement and build on the foundations in place to continue in their success.

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Appendix A - Flowchart Samples

Samples of the flowcharts produced to analyse various sections of the Production Process at Tony Stone Images.

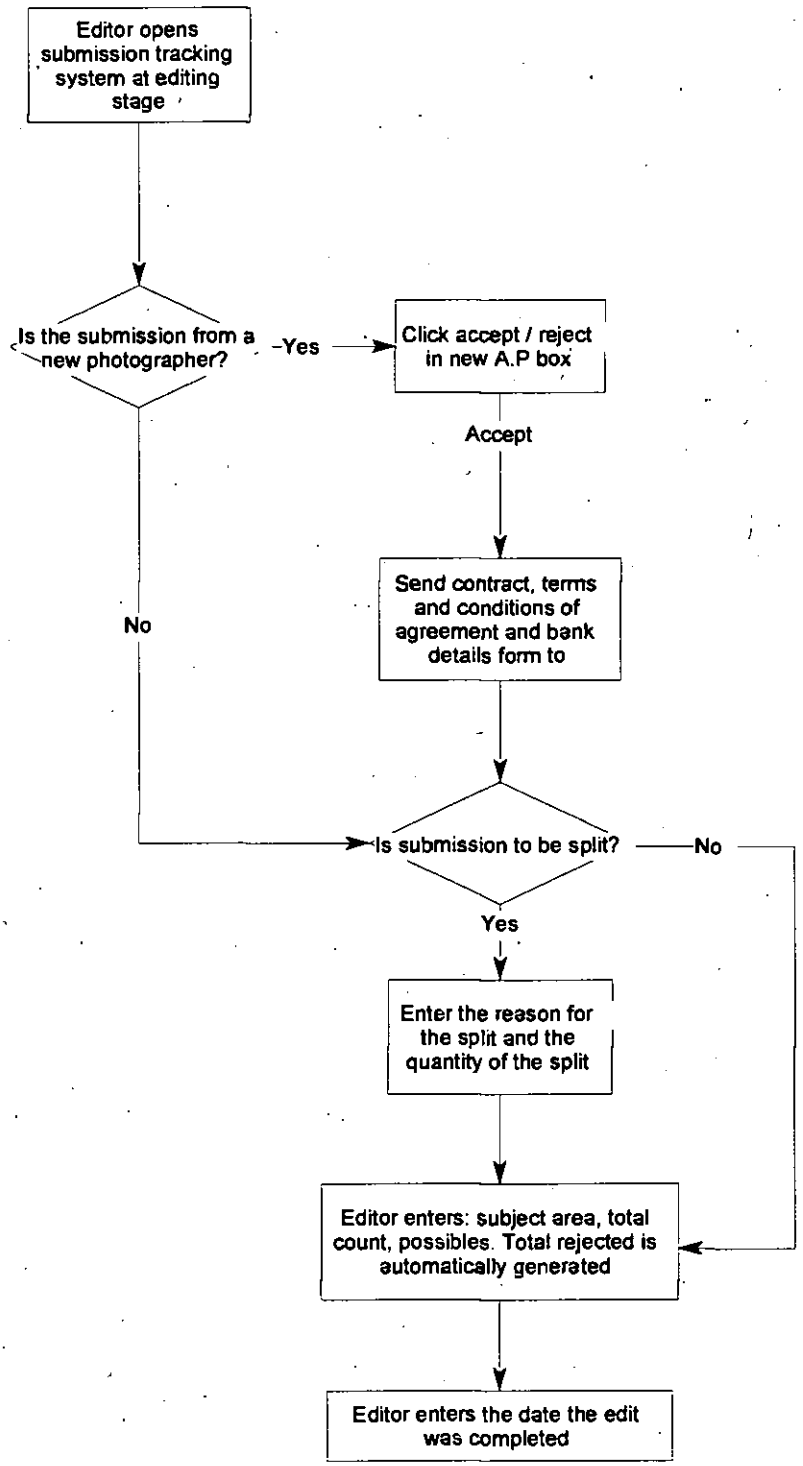


Figure A1 - Booking a submission into Creative

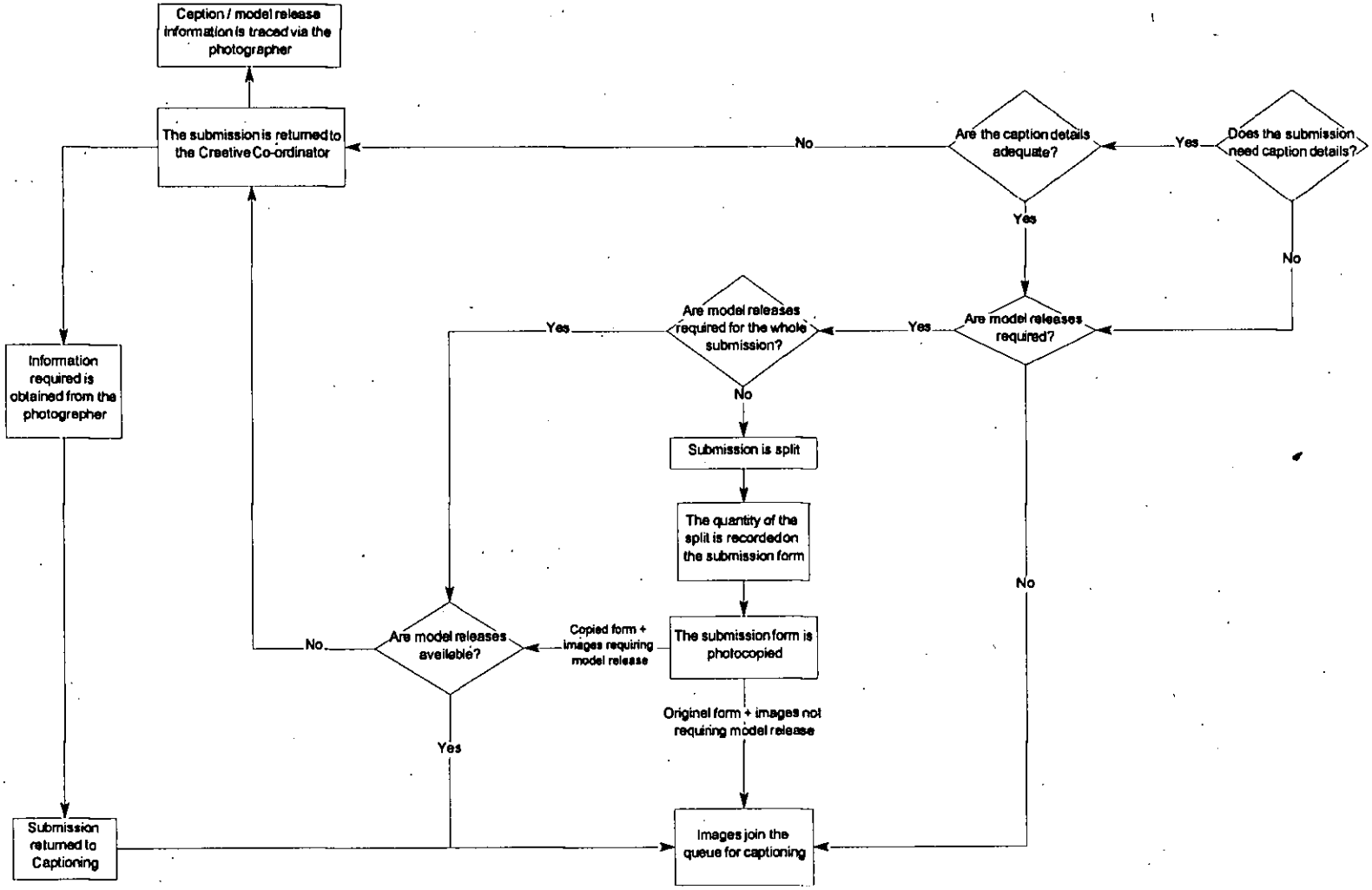


Figure A2 - Sample flowchart from image Classification (checking model release and caption information requirements)

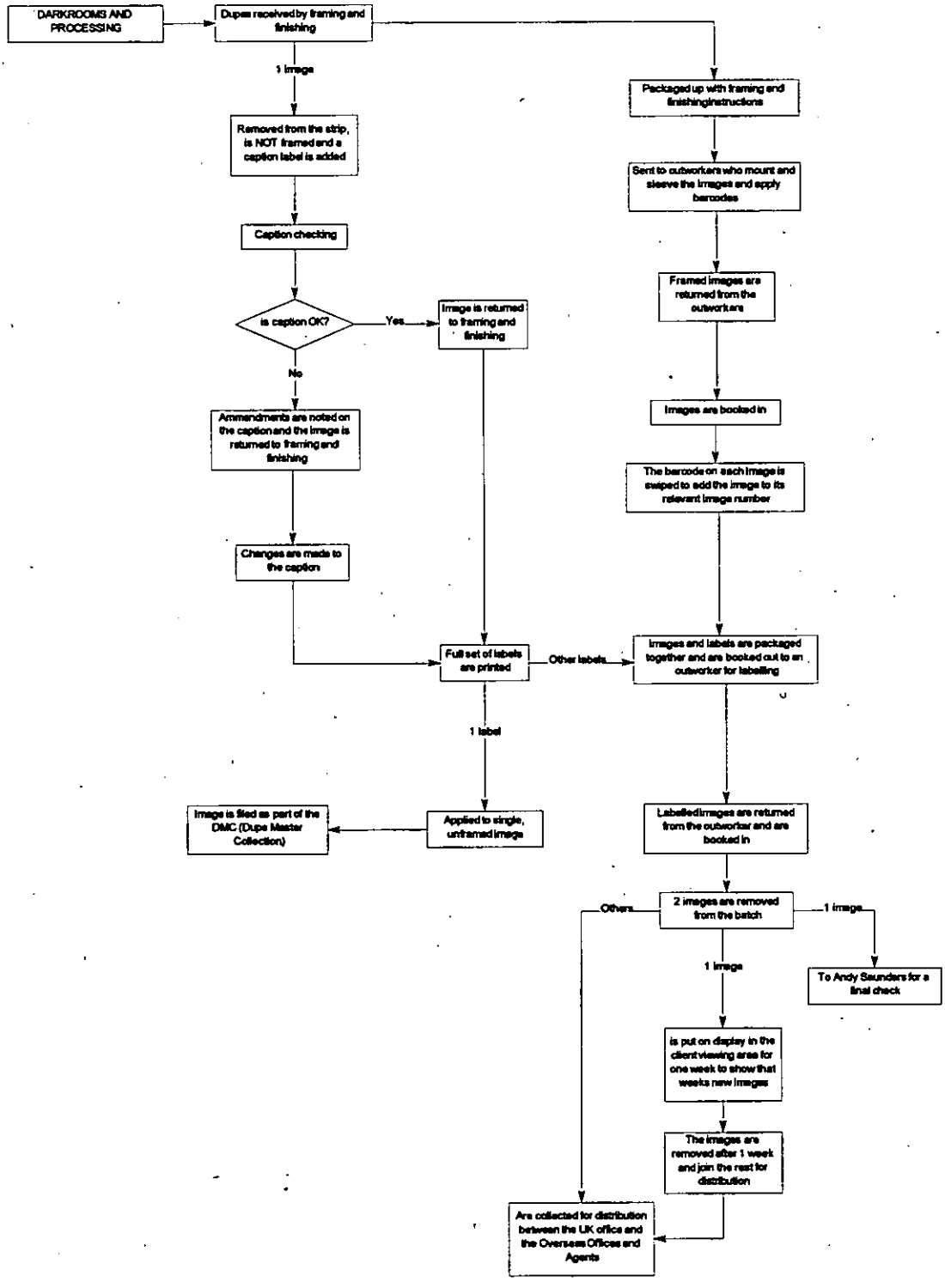


Figure A3 - Part of the Framing and Finishing Process

Appendix B - Job Tracking Form Results

Summary of Job Tracking Form Results

Type of job	Number of tracking forms	Average days in the system	Number of working weeks
Images rejected after editing	8	19	4
Images filed as originals	3	45	9
Images filed as dupes	2	85	17

Results through Editing

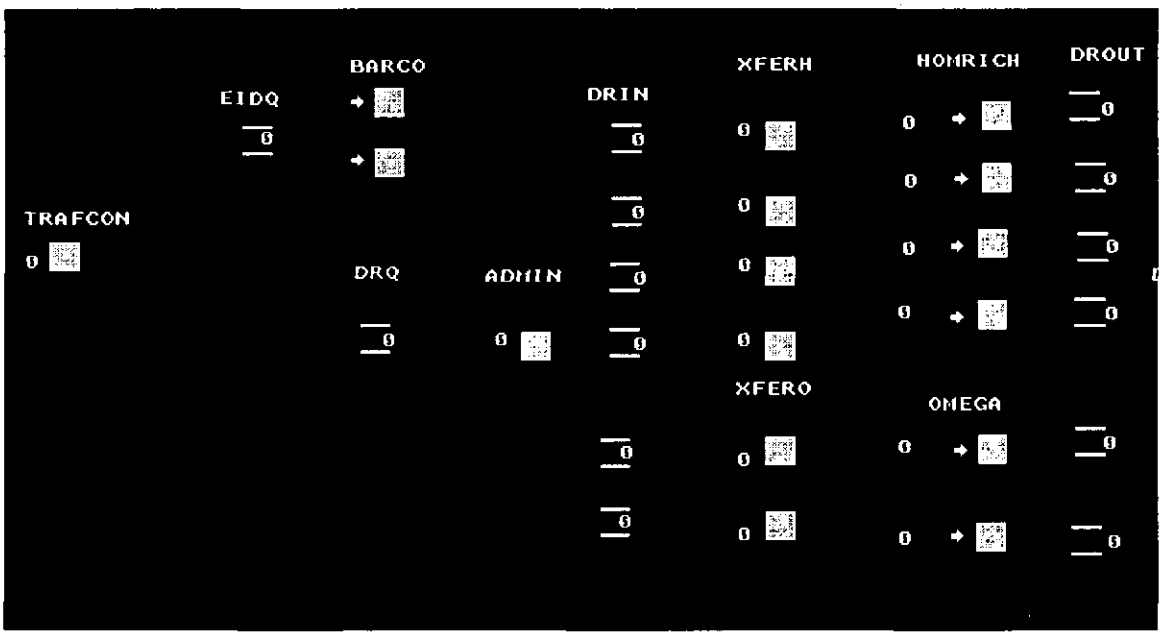
Submis-sion number	Number of pictures	Date into editing	Date / duration of first edit (mins)	Date / duration of second edit (mins)	Total editing time (mins)	Date leaving editing	Outcome
5545	40	11/1/94	20/1/94 (?)	28/1/94 (?)	?	31/1/94	return to AP
5546	24	11/1/94	7/2/94 (5)	-	5	7/2/94	return to AP
5548	67	11/1/94	25/1/94 (15)	?	15	27/1/94	return to AP
5551	27	11/1/94	14/1/94 (?)	-	?	14/1/94	Os
5560	50	18/1/94	20/1/94 (15)	28/1/94 (5)	20	31/1/94	return to AP
5561	20	18/1/94	19/1/94 (30)	-	30	19/1/94	DPs
5562	19	18/1/94	19/1/94 (45)	20/1/94 (60)	105	20/1/94	DPs
5563	71	18/1/94	20/1/94 (20)	28/1/94 (15)	35	31/1/94	Os
5566	40	18/1/94	20/1/94 (10)	28/1/94 (10)	20	31/1/94	return to AP
5572	20	18/1/94	24/1/94 (10)	28/1/94 (5)	15	31/1/94	return to AP
5573	78	18/1/94	19/1/94 (60)	-	60	19/1/94	return to AP
5734	77	16/2/94	22/2/94 (60)	-	60	22/2/94	DPs and Os
5818	120	2/3/94	10/3/94 (30)	16/3/94 (30)	60	17/3/94	return to AP

Results through Image Classification

Submission number	5551	5561	5562	5563	5734 (dupes)	5734 (originals)
Date received by dept	17/1/94	20/1/94	24/1/94	1/2/94	22/2/94	22/2/94
Number of pictures	19	4	12	8	48	as for dupes
Date / duration of numbering	18/1/94 (15)	21/1/94 (5)	26/1/94 (15)	21/2/94 (10)	23/2/94 (60)	as for dupes
Date / duration of framing	20/1/94 (30)	9/2/94 (5)	9/2/94 (40)	22/2/94 (15)	23/2/94 (15)	7/3/94 (20)
Date / duration of captioning	10/2/94 (180)	14/2/94 (10)	14/2/94 (60)	21/3/94 (25)	23/2/94 (60)	25/3/94 (120)
Total time worked on	225	20	115	50	135	200
Date job moved on	10/2/94	14/2/94	14/2/94	21/3/94	23/2/94	25/3/94
Working days in dept	19	18	16	35	1	24

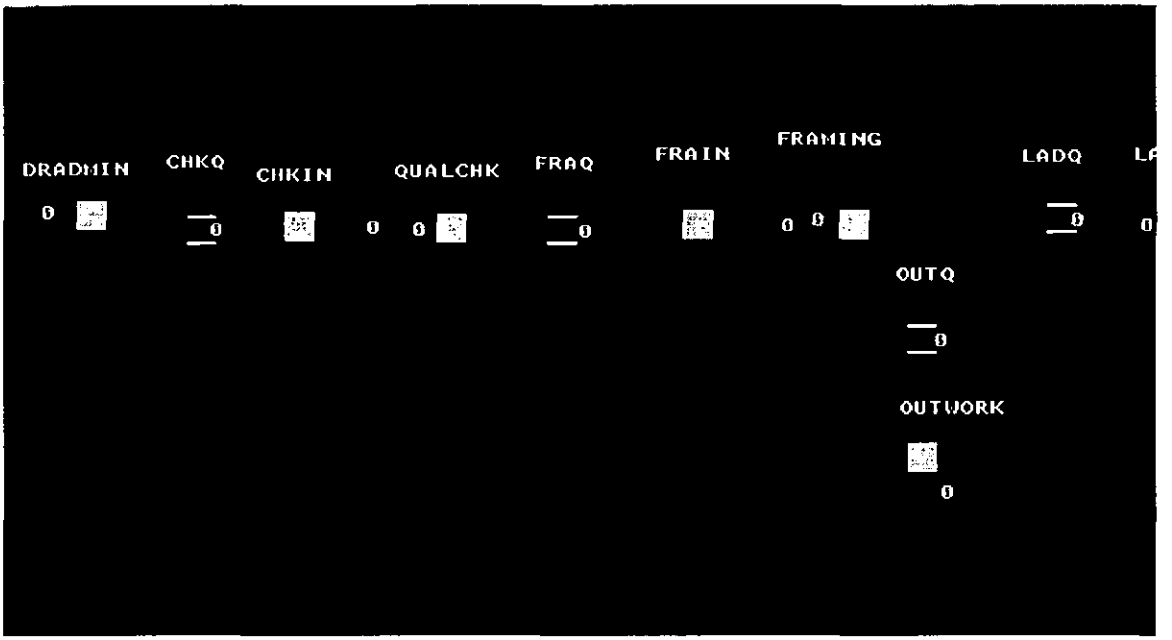
Appendix C - Witness Model Samples

The following pages show samples from the Witness production simulation models produced as one of the tools used to determine product lead time at Tony Stone Images.



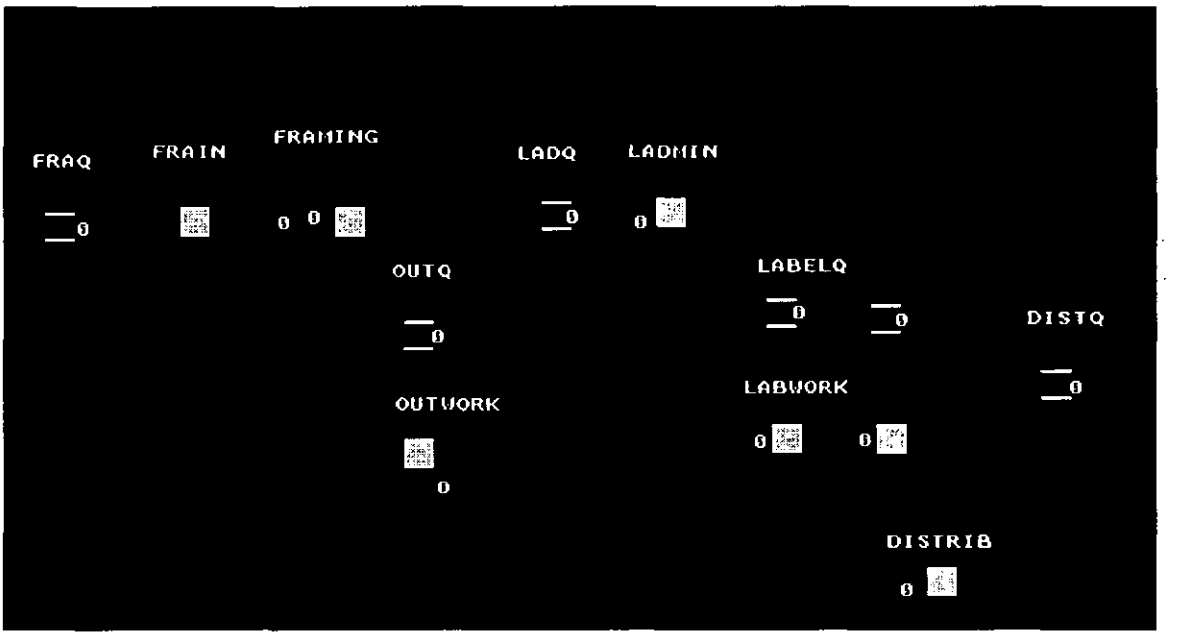
This screen shows the section of the process where images go through either Electronic Imaging into the darkrooms or directly to the darkrooms from dupe selection. The Creative department is not included in the simulation as it was not possible to accurately programme the time that images could spend in Dupe Selection waiting for a decision to be made on the picture content or quality. This determined how valuable the image was thought to be in terms of sales to the company either from the files or through being included in a company catalogue.

Stage 2



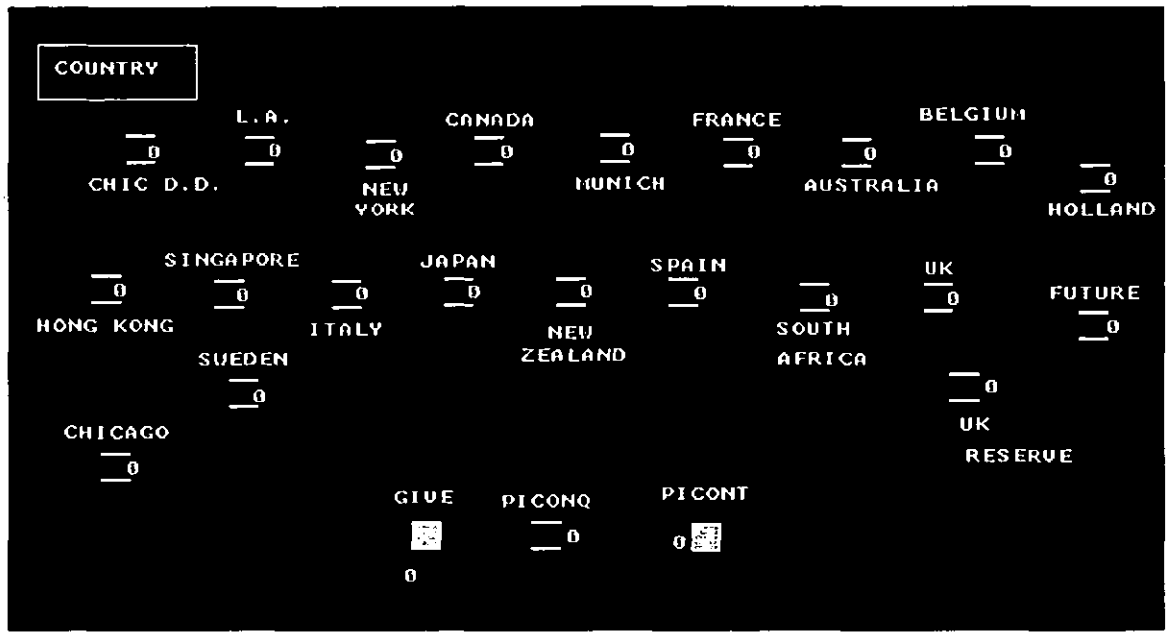
This screen covers the flow of work after images have been duped and pass into the framing and finishing part of the process where work is assigned to outworkers for completion.

Stage 3



This screen slightly overlaps with that shown in stage 2. Work enters the framing and finishing department and is distributed amongst the outworkers for the outer packaging to be applied. Images are returned to the office where they are sorted and are sent out a second time for labelling. After labelling, images enter the queue for distribution to either the UK files or international offices and agents.

Stage 4



This screen shows all of the possible destinations for duplicated images. They appear as activities where the amount of work for each is totalled and the total work passing through the simulation (i.e. production volumes) for a chosen period of time can also be totalled.

Appendix D - Loersch Report

An evaluation of using the German company Loersch to develop and automated framing and finishing machine for Tony Stone Images.

Summary

This report is the result of a two week study into the possibility of automating the framing and finishing process within Tony Stone Images, using a contact which has already been made with a German company called Loersch who manufacture machinery and materials for use in the photographic industry. Contact had already been made with Loersch as they were the only company in recent months to have shown any interest in developing machinery to handle 70mm film.

Various companies have been visited, including Loersch, to establish Loersch's credibility in being able to provide the correct equipment.

As near to a full cost evaluation as possible has been carried out indicating a potential initial saving of £140,000 when the cost of automation is compared to continuing with current working methods. When in full production the machine would cope with the production output in approximately 50% of the time available, leaving time for other work and growth in the throughput of work.

The recommendation is to go ahead with developing a machine with Loersch, following a signed contract and agreement with both parties involved. The contract is to safeguard against any extra costs and stipulations which may be imposed by Loersch as the machine would be a completely new development for them. As it will take 6 to 7 months for the machine to be developed, the outworkers need to be recognised for the work they do, have any problems dealt with and be encouraged to adopt more efficient working practices to cope with increased production.

Introduction

Tony Stone Images (TSI) is the major European agency for stock photography. In the past fifteen years, stock photography has become an essential service to the communications industry. The company stocks some 20,000 images in what is known as the Dupe Master Collection (DMC). These are images seen as being of the highest quality and of the highest selling potential, so are electronically enhanced and duplicated up to 150 times each. The DMC is backed by many thousand additional photographs of lesser importance.

The company's catalogue, currently produced annually, presents over 2,000 of the finest and most saleable images from the collection and is produced in 14 international editions. A separate US edition, incorporating additional local material, is produced for the North American market.

To remain competitive, Tony Stone Images needs to be able to reduce the time taken for product to reach the market, thus reducing the number of lost potential sales. One area which has been noted as costly and time consuming is the process of finishing duplicates. This involves the duplicates being sent out to outworkers where they are separated, mounted onto black card, inserted into a transparent protective sleeve and have a unique bar code and caption label applied. This process is currently totally manual and is very labour intensive with a total of 13 outworkers handling duplicates of many different sizes.

The project took place over the two week period of the 8th to the 19th November as part of the introductory course for the teaching company scheme.

The main objective of this report is to assess the suitability of Loersch for developing an automated / semi-automated duplicate framing system, which adheres to the specifications as laid down by Tony Stone Images, the costs and time scales involved.

In order to achieve the objective, the following activities must be completed.

- To gain an understanding of the finishing process including volumes of work completed, the number of outworkers involved and their individual activities and the costs involved.

- To visit companies who have purchased and use Loersch's products to gain first hand knowledge on the reliability and flexibility of the product.

- To clarify the specifications required to be met by Tony Stone Images.

- To gain a rough guideline of the costs and time scales involved for Loersch to develop a machine.

- To carry out a comparison of both current costs with the outworkers and future costs involving automation to make recommendations for the way forward. Both cases will involve the forecast production figures for the years 1994 and 1995.

The Current Situation

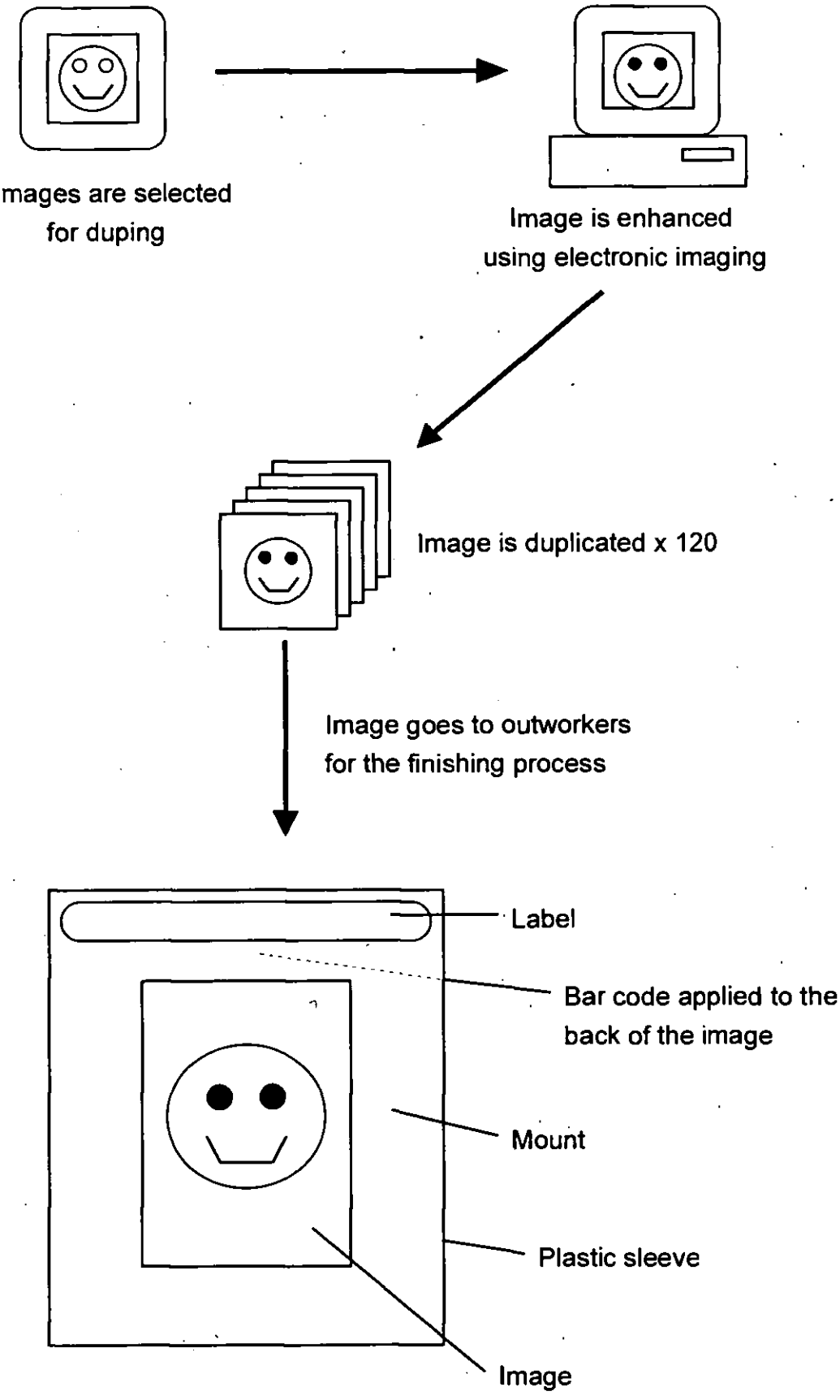
As Tony Stone Images prides itself on the quality of its images, the quality of the framing and finishing of the images before going into the stock files must be of an equally high standard.

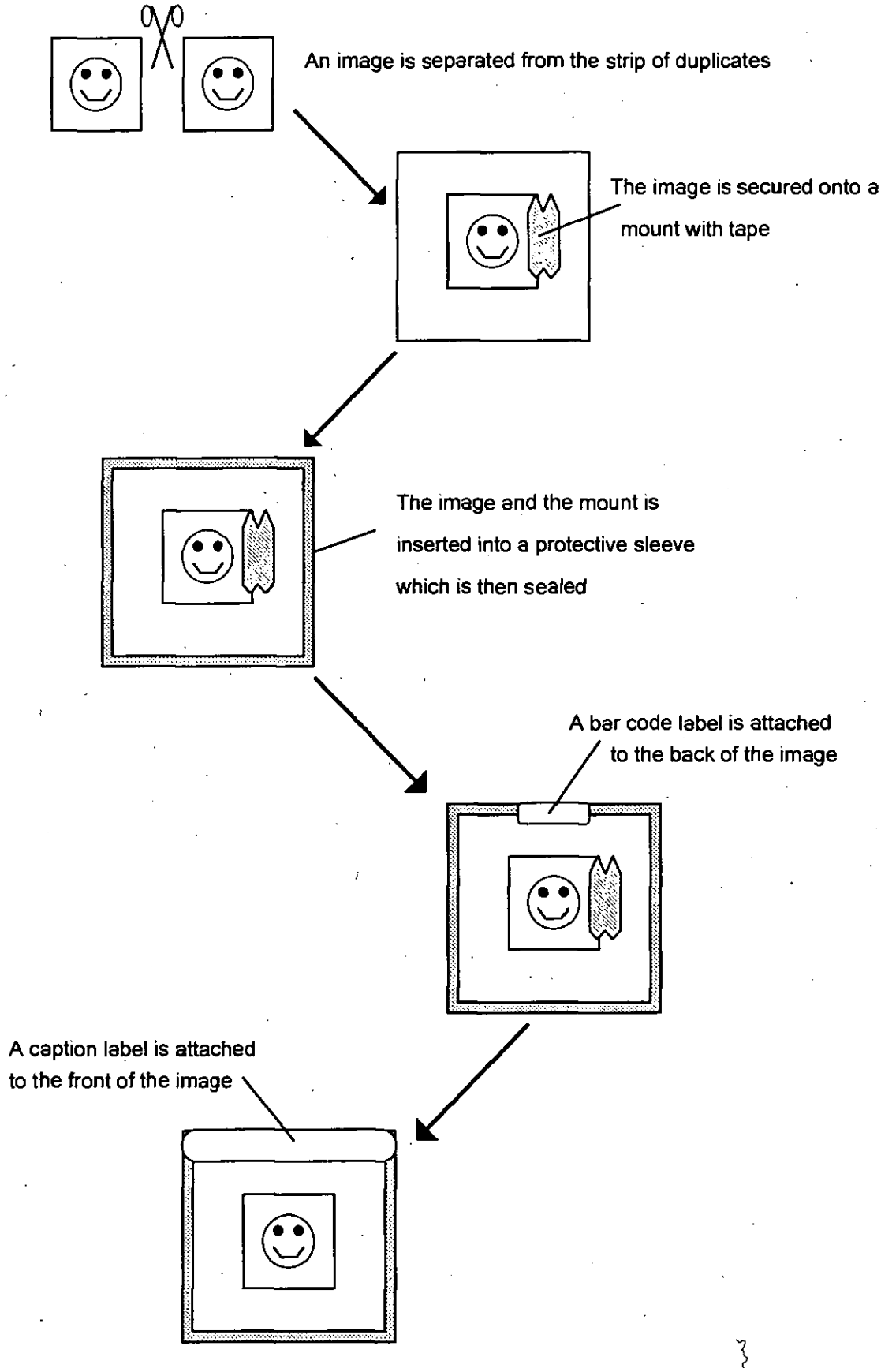
At present, the framing and finishing process is carried out by out-workers who are employed by the company to collect images and framing material once a week from the company and complete the mounting, sleeving and labelling process at home.

There are 9 outworkers involved with framing and finishing of new dupes. The whole work force of the outworkers and their roles is shown in the table below.

Name	Collects and delivers own work	Deals with new dupes	Reframes / repairs old or used dupes	Labels dupes	Sorts dupes into number order
Marion Tobin	✓	✓			
Pam Hanna		✓			
Rose Wade	✓	✓			
Florence Robinson		✓	✓		
Sandra Alleyne	✓	✓			
Shirley Phillips	✓	✓			
Wendy Phillips	✓	✓			
Jilly Phillips	✓			✓	✓
Sonia Bernhard	✓	✓			
Concetta Marchetti	✓	✓		✓	
Joyce Pearson			✓		✓
Mel Burke	✓		✓		
Brenda Reid			✓		✓

An outline of the overall process and the finishing and framing process can be seen on the following two pages.


Images are selected for duping
Image is enhanced using electronic imaging
Image is duplicated x 120
Image goes to outworkers for the finishing process
Label
Bar code applied to the back of the image
Mount
Plastic sleeve
Image


An image is separated from the strip of duplicates
The image is secured onto a mount with tape
The image and the mount is inserted into a protective sleeve which is then sealed
A bar code label is attached to the back of the image
A caption label is attached to the front of the image

Over the next two years it is the intention of Tony Stone Images to frame and finish over 1 million duplicates per year. It is therefore important to understand the capacity available and the costs involved in using outworkers to determine whether or not the current working practices will suffice the demand.

Costs of finishing and framing for forecasted production figures

	1993	1994	1995
Production forecast	**663,220**	**1,105,188**	**1,122,000**
Number of working weeks per year	48	48	48
Number of dupes requiring completion per week	13817.08	23024.75	23375.00
Average number of dupes completed by outworkers per week (current)	15500		
Wages per 20 dupe units (£)	2.15		
Total wages per average week (£)	**1666.25**	**2475.16**	**2512.81**
Cost of mounts per 100 (£)	4.10		
Total cost of mounts per average week (£)	**635.50**	**944.01**	**958.38**
Cost of sleeves per 100 (£)	7.50		
Total cost of sleeves per average week (£)	**1162.50**	**1726.86**	**1753.13**
Cost of picture labels per 1000 (£)	5.42		
Total cost of picture labels per average week (£)	**84.01**	**124.79**	**126.69**
Cost of bar codes per 1000 (£)	8.50		
Total cost of bar codes per average week (£)	**131.75**	**195.71**	**198.69**
Cost of sellotape per box - 24 rolls (£)	13.43		
Number of rolls used per week	40.00	66.66	67.67
Total cost of sellotape per average week (£)	**22.38**	**37.30**	**37.87**

Labour cost of labelling at 600 labels per hour (£)	4.9		
Number of hours required for an average weeks work	25.83	38.37	38.96
Total cost of labelling per average week (£)	**126.58**	**188.04**	**190.90**
Outworkers transport costs per week (£)	10	10	10
Outworkers transport costs per year(£)	**480**	**480**	**480**
Total cost of dupe finishing per average week (£)	**3838.98**	**5701.87**	**5788.46**
Total cost of dupe finishing per annum (£)	**184,270.88**	**273,689.81**	**277,845.85**

The spreadsheet shows the forecast production figures for the years 1994 and 1995. These are then multiplied by the costs of required raw materials and the wages paid to the outworkers for a final figure. It must be remembered however that costs of raw materials will probably change between now and the end of 1995.

By 1995, the cost of sending work out for framing and finishing will have gone up by £100,000. This does not include possible increases in raw material costs due to inflation or having to source from a different supplier.

If Tony Stone Images is to go ahead with the acquisition of a machine to automate the dupe framing and finishing process, it will take some time for the machine to be delivered. Up until then, the best use of the current resources needs to be made and those resources are the outworkers.

A short term solution to the problem may be to bring the outworkers in to the company and run a half or full day session with them to find out each others ways of working and see if anything can be learned. Those who work faster will be able to show the slower ones how they manage it etc. After all, the best people to ask are those doing the job.

A Possible Solution

Loersch

Loersch is a German company based only 5 KM from the dutch border near Dusseldorf. It employs approximately 200 employees in the German factory and has an agent for their machinery in the United States. Loersch manufacture machines for use within the photographic industry, primarily dealing with 35mm film. Their main line of business is to manufacture and sell the materials to run on the machines. At present they offer no products which deal with handling 70mm film.

The contact with Loersch has already been made by Tony Stone Images through their agent in the UK, George Elliot.

Through George Elliot, it has been possible to see Loersch's product range, both at the PhotoLab exhibition in Wembley and by visiting the Loersch plant in Dusseldorf.

Loersch have indicated an interest in venturing into the 70mm film handling industry and feel that a machine capable of meeting the requirements and specifications set out by Tony Stone Images can be developed and built. The specifications are as follows:

General Specification

1. To maintain/enhance the visual quality of the product.

2. To speed up the cutting, framing and finishing process time.

3. To be cost effective.

4. To be readily serviceable should any faults occur.

Machine Specification

1. To be able to handle 70mm exposed film of variable length.

2. To accurately cut the film (with a small tolerance) to separate each individual image.

3. To position and fix each image accurately onto a mount (passé partout) without obscuring any of the image area.

4. To insert the mounted film into a protective sleeve which is then sealed.

5. To accurately position the product reference label.

6. To be fitted with some method of regulating the amount of dust and static present in the framing process.

Material Specification

The sleeves need to be made out of a material which is inert such that they will not react with the film on contact.

Other Issues

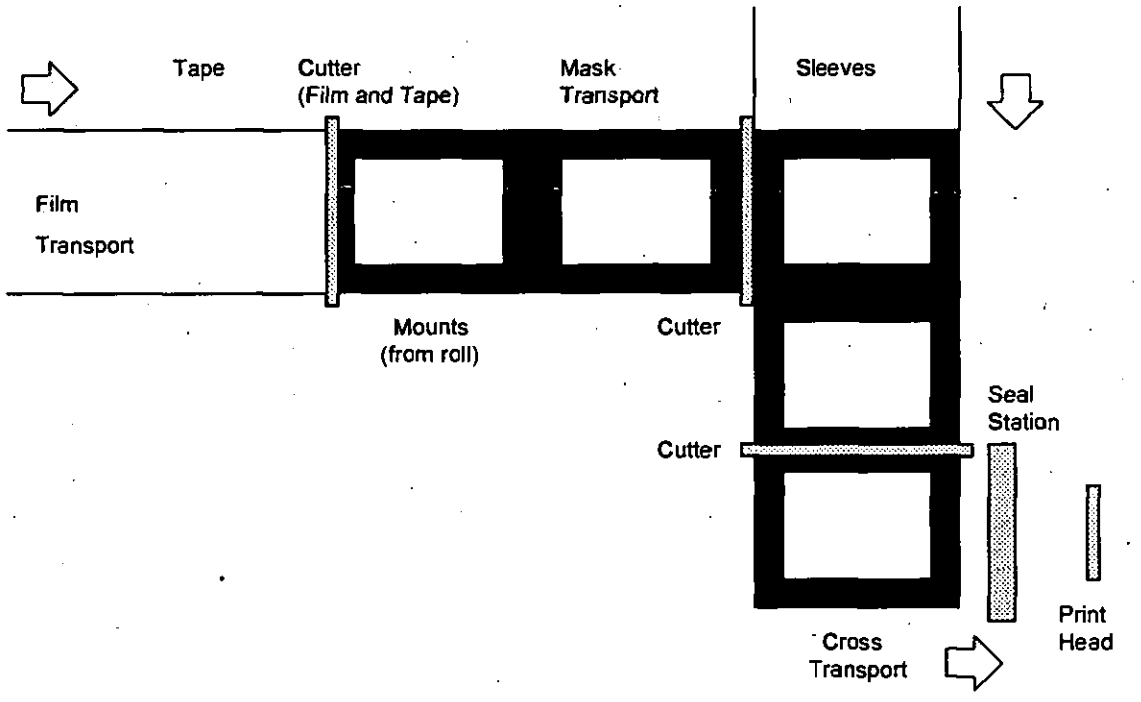
1. Due to various Health and Safety at work regulations, any machinery with moving parts needs to be properly guarded to avoid accidents and those operating the machine must receive full, comprehensive training. Guarding regulations in other countries are not as strict as in the UK, it may therefore be necessary to seek the guidance of the local Health and Safety Executive if any machinery is bought from overseas.

2. Any company supplying any chemical product for industrial use is required to supply a COSHH data sheet (Care Of Substances Hazardous to

Health). If any washing solutions, gums, cleaners of any kind are recommended for use with the machinery proposed by Loersch the relevant data sheets must be obtained. The data sheet details the use of the product, any protective clothing which is required to be worn, the length of safe exposure to the chemical etc. and what should / should not be done in an emergency in which the product was involved.

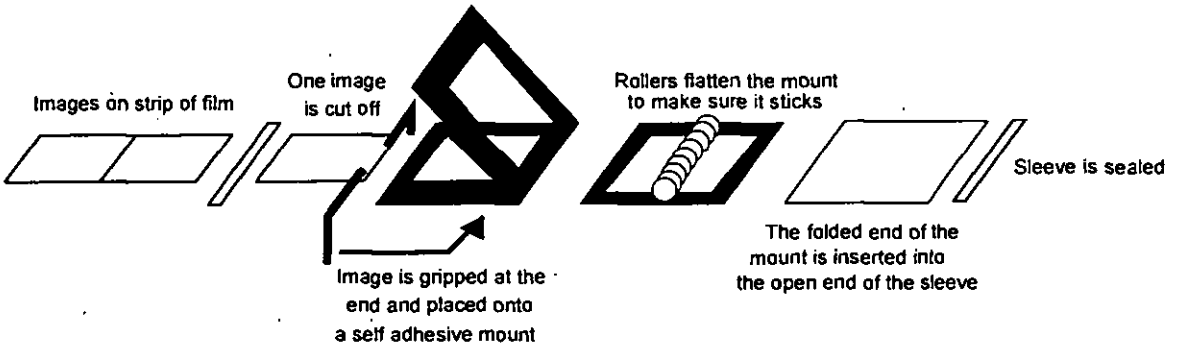
3. By the nature of its action, machinery makes noise. It is highly unlikely that the noise from an automated wrapping machine would be so loud as to exceed the recommended noise levels before hearing protection is required to be worn by the operators, however it was felt necessary to raise the point.

The above machine specification indicates the functions required by the framing and finishing machine. It may however be feasible to use a separate labelling machine as these are already on the market and are available to purchase.
The following diagram is a possible layout of the machine which has already been suggested by Loersch.



The previous diagram was drawn with the intention of using the same or similar materials to those which are currently used for mounting images. If there is no

restriction on the type of mounts and sleeves used, the following machine design using folded self adhesive mounts could be adapted to suit.



Other Contacts / Issues

A visit was made to primary colour who process all of the film used by Tony Stone Images. It was suggested by them that as they already sleeve the transparencies, a second sleeving process was not necessary. The alternative would be to carry out the quality checks in the darkroom as usual, cut off any unsatisfactory images and then mount the sleeved image. A self adhesive fold-over mount could be used so that the image is totally enclosed in the mount to avoid any dust damage. (Inside out in comparison with current methods).

Primary Colour also suggested that Tony Stone Images may consider a viewing aid which is made by a company called Perforag. Perforag's main line of business is in the cine business. The viewing aid is a reel to reel spooler over a light box, allowing each image to be viewed from the reel without being handled. It is believed that there is also a coding device on the machine which could number the images.

Loersch's Credibility

In order to make recommendations on the suitability of Loersch for providing a duplicate finishing machine to Tony Stone Images, it was felt necessary to visit various companies who already use Loersch products. These visits were used to put together a more complete picture of Loersch in terms of

- After-sales service
- How robust the machinery is
- Quantities dealt with
- The use-ability of Loersch's products
- Flexibility

The following companies were visited.

Alpha Press - Tuesday 9th November

Alpha Press deal with the supply of up-to-the-minute photographs of celebrities and famous people. These include royal visits to locations around the world, actors and actresses of the latest films, stage productions and music artists.

The editing, processing and duping of 35mm film all takes place in house. Images are then framed in 35mm slides and placed in view packs for distribution.

Loersch has supplied Alpha Press with two framing machines and one captioning machine. High volumes of slides are produced from the machines and everyone is able to use them.

Allsport - Tuesday 9th November

Allsport deal with the up-to-the-minute supply of action shots from all sporting events around the world. Images are either sent in on a roll of film or can be transmitted electronically in 35mm format. Again, the editing, processing and duping stages are completed in house.

Loersch has supplied Allsport with two framing machines and one captioning machine. Again the machines produce a very high volume of slides, they are robust and are used by more than one person. The captioning machine has

been of great benefit to Allsport as they have two machines from a company called Technodia which have not been very reliable. Until the machine from Loersch was purchased there was a certain amount of doubt as to the completion of work in time to meet deadlines.

The following table shows how the products supplied to Alpha Press and Allsport meet the criteria required by Tony Stone Images as stated above.

Company	After sales service	Robust	Throughput quantity	Ease of use
Alpha Press	?	✓	High	✓
Allsport	✓	✓	High	✓

With the limited time available, it has not been possible to fully asses the reliability of a Loersch product, but the above table shows that which was gained from first impressions and talking to employees from each organisation.

Costs and Implications

Outworkers

The biggest issue which immediately springs to mind when considering the automation of a manual process is the jobs which are to be lost. In this case it is the outworkers who may no longer be required.

The question over how many outworkers will be lost and how many will still be required depends on the handling capability of the machine. It needs to be able to handle the high volume, most common sizes. The sizes of frames used are given in the table below.

Item	Aperture (mm)
SAPS	82 x 119
LAPS	94 x 119
74s	56 x 74
81s	56 x 81
84s	56 x 84
Panoramics	75 x 187

The most common size in terms of volume is the 84 frame. There is also quite a large number of dupes framed in the 74 frame. Also, the 81 frame is being phased out with less work requiring this size. An estimate of the breakdown of work to sizes is as follows:

70% - 84s
25% - 74s
5% - Others (LAPS, SAPS, 81s, Panoramics)

This being the case, the machine would deal with 84s and 74s which would mean there would need to be the facility of adjusting the length of pull from the strip of film by 10mm. The remaining sizes could be dealt with by outworkers, but as there is no control over how often these sizes come up, it may be easier to deal with them in house.

Loersch

At present, Loersch feel they can supply Tony Stone Images with a machine capable of carrying out the finishing and framing operations for approximately £40,000. The machine should be capable of finishing 15 - 20 images per minute.
Each machine would come with a 1 year mechanical guarantee and a 6 month electrical guarantee. Also, optional to the customer, a full service contract can be drawn up for as many years as the customer requests. This is an extra 10% cost to the full amount. This would make the cost of the machine £44-£45,000. (Paul Sparks has admitted that a service contract does make Loersch a lot of money and the response rate for calling an engineer out is no quicker than it would be without a contract).'

The cost of the machine does not include the cost of framing material. Loersch have stipulated however that part of the contract for supplying the machine will tie Tony Stone Images to buying all of the required framing material from

Loersch. This has been quoted at approximately 250 dm per 1000 sleeves. At an exchange rate of 2.4975 dm to the pound, this equates to £100 per 1000 sleeves.

Depending on the finished size of the machine 2 people will be required to operate and adjust the machine. This includes keeping various hoppers filled with sleeving materials and dupes. An average salary at the time of writing is approximately £12,000 p.a.

	1994	1995
Production forecast	1,105,188.00	1,122,000.00
% of dupes to be finished automatically	88.6	88.6
Number of dupes to be finished automatically	979,237.00	994,103.00
Number of working weeks per year	48.00	48.00
Annual cost of mounts and sleeves @ £100 per 1000 (£)	97,923.70	99,410.30
Annual cost of labour @ £12,000 per employee	24,000.00	24,000.00
Cost of picture labels per 1000 (£)	5.42	5.42
Total cost of picture labels per year	5,307.46	5,388.04
Cost of barcodes per 1000 (£)	8.50	8.50
Total cost of barcodes per year (£)	8,323.51	8,449.88
Cost of weekly power usage of 500W per hour @ £0.084 per KWhr	1.47	1.47
Total cost of power per year	70.56	70.56
Total cost of dupe finishing per year (£)	135,625.24	137,318.77

The cost of dupe finishing per year by automation compared with that of continuing dupe finishing with the outworkers is as follows.

Dupe finishing with outworkers (1994) = £273,689.81

Dupe finishing by automation (1994) = £135,625.24

The figures show that to automate in 1994 there is a potential saving of approximately £140,000.

It can be assumed that the potential saving will be more in 1995 due to the expected rise in production. The figures shown are as accurate as possible at the moment but may need revising depending upon the time taken to make a decision on automation. Loersch have indicated that they will provide a more up to date quote for the machine and raw materials before the 9th December 1993.

The above spreadsheet shows the costs incurred for dupe finishing if a machine were to be in use. The main reduction in cost is that of labour. Also the cost for labelling has not been included as this operation is also to be automated, either with the machine purchased from Loersch or as a separate unit - which are already available off the shelf.

During development of the machine, Tony Stone Images must remain in close contact with Loersch at all times, to make sure that the requirements are met and to be notified of any changes in expenditure.

As framing and finishing products are not already on the market for dealing with 70mm film, the product development by Loersch will involve a certain amount of learning by trial and error. It is therefore unlikely that the lead-time for the delivery of the machine, the speed at which the machine can run and the final cost of the machine will match those quoted.

It is possible that half way through the development stage Loersch need to put the price of the machine up for some reason. This possibility needs to be addressed by Tony Stone Images and before work begins, offer the £40,000 as

a fixed sum due to the fact that building the machine will be a joint learning process for both parties and the machine which Tony Stone Images eventually receives will essentially be a prototype. As a result of the work done with Tony Stone Images, Loersch will be able to market a similar product at probably a fraction of the price to other 70mm film users.

Method of Payment

The method of payment with Loersch has not been clarified, but as guidance, two methods of payment used when purchasing machinery are as follows.

- The first is where the customer pays 10% of the cost up front and clears the remaining 90% when the machine is delivered.

- The second is where the customer pays 10 % up front, 45% half way through the delivery lead time given (assuming everything is on track) and clears the remaining 45% on delivery.

A method of payment to suit both parties can be negotiated when drawing up the contract.

Raw Materials

As is seems likely that Loersch will require our framing and finishing materials to be purchased from them, as the machine will be designed to run the most effectively using Loersch material, the following points need to be considered.

- Loersch is located approximately 5 Km from the Dutch border. The factory is 45 minutes to an hours drive to Dusseldorf airport and the next closest airport is two hours drive. Once contracts have been set up, the delivery of raw material should not become a problem but it is important to take into consideration the location of the plant and also the fact that they are overseas and so would be Tony Stone Images only overseas supplier.

- Continuing the issue of Loersch being overseas, there is the problem of the exchange rate between sterling and the German mark. A clause may need to be written into the contract that the price of raw materials is reviewed every six months to either the exchange rate on the day of price adjustment or the average exchange rate over the last six months.

The Stock Photography Market

The storage and transmission of images is becoming more and more digitised with the birth of CD-ROM. It is possible therefore that clients will no longer require a framed and finished transparency but will want a selection on CD. This being the case, an automated framing and finishing machine will be useful in the short term but how popular it will be in the long term remains to be seen. A good understanding of the trends in the stock photography market needs to be gained.

The biggest problem with CD-ROM will be keeping it current, for example updating it with all of the new images for a week including originals and dupes. CD-ROM may be best kept for the catalogue, assuming that all of those receiving one have the facility to read it.

Machine Capacity

The machine will be manufactured to run at a speed of approximately 20 finished units per minute. Allowing 25% for job changes and downtime, the production rate will be 15 finished units per minute.

	1994	1995
Forecast production figures	1,105,188.00	1,122,000.00
Number of dupes finished by automation	979,237.00	994,103.00
Machine finish rate (units per minute)	15.00	15.00
Number of units completed in a week	31,500.00	31,500.00
Number of weeks required to complete production forecast	31.09	31.56
Number of weeks in year remaining	16.91	16.44
% of working year idle	54.41	52.10

The above table shows that by automating framing and finishing, the high volume, standard sizes can be dealt with in just less than half of a working year. On a week to week basis, this is proportional to 2.5 to 3 days a week. The remaining two days in every week can then be used to frame and finish the odd sizes.

As the machine will be able to deal with images quickly, the flow of work leaving the darkrooms will need to be regulated. If it is only possible to release work to framing and finishing once a week then the machine operation time needs to be planned accordingly. If work can be released on a daily basis then part of each day will be taken up in framing and finishing and the remainder of the day the machine will be idle. The knock on effects to other operations of automating framing and finishing needs to be realised.

Statement and Evaluation of the Alternatives

Choose not to automate.

This would involve the company not automating the framing and finishing process, but the working methods need to be analysed.

The outworkers should be given some recognition for the work they do and the value that the framing activity has to the company. This would involve:

Either

Send a questionnaire out to each outworker with their batch of dupes. The questionnaire will ask questions about the quantities the outworkers manage, how long they take to complete each batch, do they feel there ought to be a better way of working than the one they use etc. Also with a section for the ouworkers to raise any problems they may be having related to the framing and finishing of dupes.

Or

An individual from Tony Stone Images visiting each outworker on a personal basis. The outworker would have the opportunity to raise any issues which she feels is important. These may be the quantity of the work they receive, the day they receive their work or the methods they use for framing and finishing.

Or

Invite all of the outworkers in to the company and run a seminar to cover any problems or issues the outworkers may wish to raise and to ask them all to get together and share their working methods. This way a quicker, more effective way of manually framing and finishing the dupes should be achieved.

The advantages and disadvantages of choosing not to automate are as follows.

Advantages

1. There would be no disruption to current working methods.

2. Better relationships between the outworkers and the company would be formed.

3. A more productive use of the outworkers would be gained.

Disadvantages

1. Eventually the outworkers would not be able to keep up with the production volumes produced and the only solution would be to take on more outworkers.

2. The costs would go up in relation to the rise in production output as the outworkers are paid by the quantity they complete.

Use Loersch to develop and supply an automated framing and finishing machine.

By using Loersch's expertise in the photographic industry to develop an automated framing and finishing machine, Tony Stone Images would be ahead of their competitors in handling 70mm film. It is felt however that a labelling machine should be purchased separately as one could literally be in use by 1994, and that the final specification for the machine set by Tony Stone Images should leave space just before the framing process and just before the sleeving process to develop the facility of printing should it be required.

The machine supplied by Loersch would not have the facility of scratching or marking each frame on the film with the picture code and slash number. The lead of a viewing and coding machine produced by Perforag should be pursued.

A more up to date quote for the supply of the machine and the raw materials is to be given.

The advantages and disadvantages of going ahead with the development of an automated framing and finishing machine with Loersch are as follows.

Advantages

1. Tony Stone Images would have a potential initial saving of £140,000 for 1994.

2. The machine has enough capacity to deal with almost twice the forecast production output.

3. Costs would be saved in terms of labour.

4. Spare time when the machine is not required to be running could be used to frame and finish the odd sizes of dupes produced.

5. Tony Stone Images would be ahead in the 70mm market.

6. The time taken for dupes to be in stock and therefore become saleable would be reduced.

7. Loersch have a successful record of developing new machinery with two of their own inventions running a full production schedule in their factory.

Disadvantages.

1. Development of the machine would be new to Loersch as they have not had many dealings with 70mm film.

2. Raw materials would be supplied to Tony Stone Images by Loersch, thus restricting competitive purchasing.

3. The supply of raw materials from Germany may not be totally reliable.

4. The German mark to sterling exchange rate fluctuations need to be considered.

5. The development and delivery lead time is six months (already half way through the production forecast for 1994).

Carry out a search in greater depth for other companies willing to develop a 70mm film handling, framing and finishing machine.

This alternative would allow a broader picture of machinery available to be built up, It may be that after the analysis of each proposal Loersch's is still the best,

but it will be a known rather than a feeling. The advantages and disadvantages are as follows.

Advantages

1. A broader picture of the competition for developing 70mm film handling, framing and finishing machines would be gained.

2. The costs of each could be compared so that the quote from Loersch can be deemed realistic or not.

Disadvantages

1. This would take up even more time and so a machine may not be available until 1995 - a years potential savings would be lost.

2. All of the work may be done and Loersch could still be the company to go with - again time and savings are lost.

Recommendations and Implementation.

The recommendations and implementation plan for automating the duplicate framing and finishing process are as follows.

A combination of both alternatives 1 and 2 from the previous section are recommended as the way forward for Tony Stone Images.

It has been recognised that the process needs to be automated and the proposal by Loersch to build a machine should be taken up. on commencing work with Loersch the following points should be agreed.

1. The full specification of the machine needs to be agreed by all of those necessary at Tony Stone Images as Loersch are prepared to build whatever is asked for. Future requirements also need to be considered.

2. The method and cost of supplying the raw materials to Tony Stone Images should be agreed.

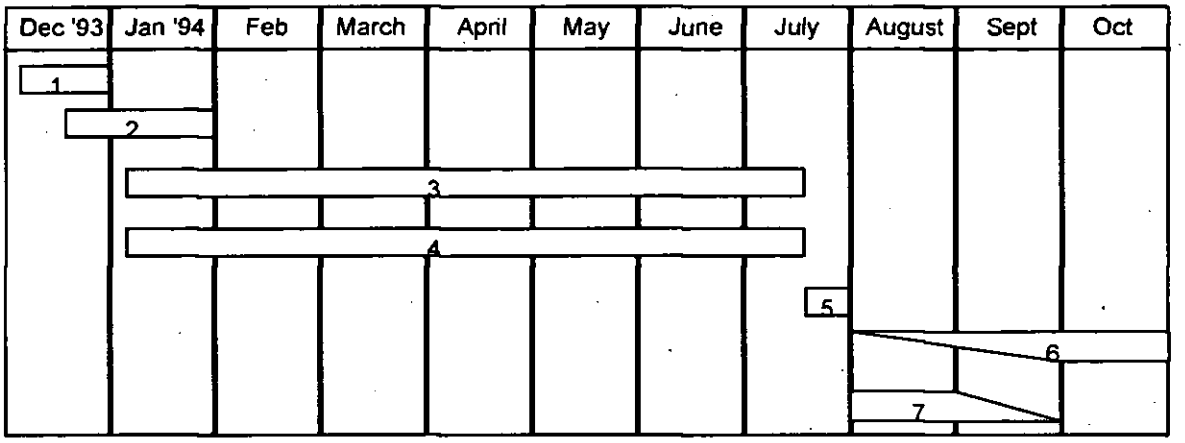
3. The method of servicing and repairing the machine should be agreed.

4. As the machine will effectively be a prototype for future products for Loersch, Tony Stone Images need to negotiate the longest guarantee for electrical and mechanical and any other faults which may occur on the machine.

5. The final quote for the cost of building and supplying the machine, along with the method of payment needs to be agreed.

6. Any moving parts on the machine need to be fully and properly guarded, due to the Health and Safety at work regulations. The requirement for guarding needs to be included in the final specification set out by Tony Stone Images for Loersch.

As any machine built by Loersch cannot be supplied for approximately six months, attention needs to be paid to the current working methods. The outworkers should be recognised for the work they do for the company and anything which can be done to improve their working methods and increase production output should be addressed. A possible plan for the development and delivery of the machine to Tony Stone Images by Loersch is below.



Key.

1. Machine specification written by Tony Stone Images, quotes given by Loersch, a contract and agreement including the above points made is drawn up and signed by both parties.

2. Improvements are made to the outworkers methods and any problems they raise will be dealt with.

3. Loersch carry out the development and building of the automated framing and finishing machine.

4. Tony Stone Images work very closely with Loersch to ensure the specification is met and time scales are adhered to.

5. The machine is delivered to and installed in Tony Stone Images.

6. The machine comes on stream as part of the production process, initially dealing with quantities increasing as training is carried out and completed. The after sales service and support contract with George Elliot becomes active.

7. The outworkers are phased out as the training programme on the machine becomes completed.

Conclusion

In order for Tony Stone Images to remain competitive, more images need to be made available to the market in shorter time scales. One area of the process which would aid in the speeding up process is that of duplicate finishing and framing. To this end it was decided to investigate the possibility of automating the framing and finishing process and this report covers one contact with a German company called Loersch who manufacture machines and materials for use in the photographic industry.

Two weeks were spent looking around different companies who already use Loersch's products for their reliability, cost effectivity, ease of use and working capacity. Also, a visit was made to the PhotoLab exhibition in Wembley where George Elliot had a stand displaying Loersch's products. Finally a visit to Loersch was made to have a look around the plant and assess the manufacturing capability of the company for supplying Tony Stone Images with what they require.

Analysis of the expenditure with current processes along with possible future expenditure with automated processes was made. This revealed a possible initial saving of £140,000 in 1994 if the decision to automate were to be made.

On the basis of the cost and company analysis, the recommendation has been made to go ahead with automation using Loersch to develop and build the framing and finishing machine. Tony Stone Images would have to work very closely with Loersch, both following a previously agreed contract, and the after sales support and service by George Elliot will need to be present.

Tony Stone Images also needs to improve the working methods of the outworkers who deal with current framing and finishing to ensure that increased production volumes can be dealt with.

If work begins on development in the new year of 1994 the whole process may take until the end of September 1994 to have the machine on stream in full production.

The benefits of automating the framing and finishing process at Tony Stone Images will provide a better time to market of the dupes and fire enthusiasm for continuous improvement throughout the whole of the company.

Appendix E - Critical Path Analysis

A Critical Path Analysis was carried out in August 1994 to justify whether or not Tony Stone Images could conceivably produce 3 catalogues per year given the constraints on production in terms of resource at the time.

Key

A UK submissions arrive

B UK submissions booked in from Aps

C Submissions edited

D Submission through Image Classification

E Images through dupe selection

F Images sent to Seattle for selection

G LA submissions arrive

H LA submission booked in from Aps

I Submissions edited

J Submissions through Image Classification

K Images through dupe selection

L Images to London

M Seattle submissions arrive

N Seattle submissions booked in from Aps

O Submissions edited

P Submissions sent to LA for Image Classification

Q Submissions through Image Classification

R Images returned to Seattle

S Images to London

T Listed catalogue possibles are pooled in London

U Subject selection - duping / imaging instructions added according to available capacity

V In house production of catalogue (Seattle) - scanning, page layout, pic codes, proof reading, checking AP approvals etc.

W Laid out pages and originals sent to UK

X Selected originals entered onto catalogue database and reassess duping / imaging decision

Z Originals to Imaging

AC Originals enhanced and output

AD DDM to publications

AE Advance copu to catalogue captioning

AI Captions added to catalogue database

AJ Captions added to page layout

AK Proof reading

BE Pages to repro

BF Colour correction

BG + 60 days for the remaining 12 categories

BH Printing

BI Binding

BJ Shipping

Y Originals to duping

AA Duping and quality check

AB Advance copy / test to publications

AH Advance copy to catalogue captioning

AG Advance copy to dupe caption check

AN Caption check

AO Update cpation in Image Classification

AF Dupes to framing and finishing

AM Dupes prepared for the outworkers

AP Dupes with Outworkers for framing and barcodes and returned

AU Labelling admin (modify ICATS, print labels, and package up for the outworkers)

AV With outworkers for labelling

AX Distribution - UK pictures to file maintenance

AY UK pictures filed

AZ + 60 days for the remaining 12 categories

AW Distribution - Oos and As pictures to Picture Control

BA Oos and As pictures through Picture Control to Despatch

BB Pictures shipped to Oos and As

BC Pictures filed by Oos and As

BD + 60 days for remaining 12 categories

AL DMC copy removed

AQ DMC copy labels printed

AR DMC copies to picture research

AS DMC copies filed

AT + 60 days for the remaining 12 categories

Figure E1 - First section of the Critical Path Analysis for Catalogue production at TSI

Figure E2 - Second section of the Critical Path Analysis for Catalogue production at TSI

Figure E3 - Final section of the Critical Path Analysis for Catalogue production at TSI

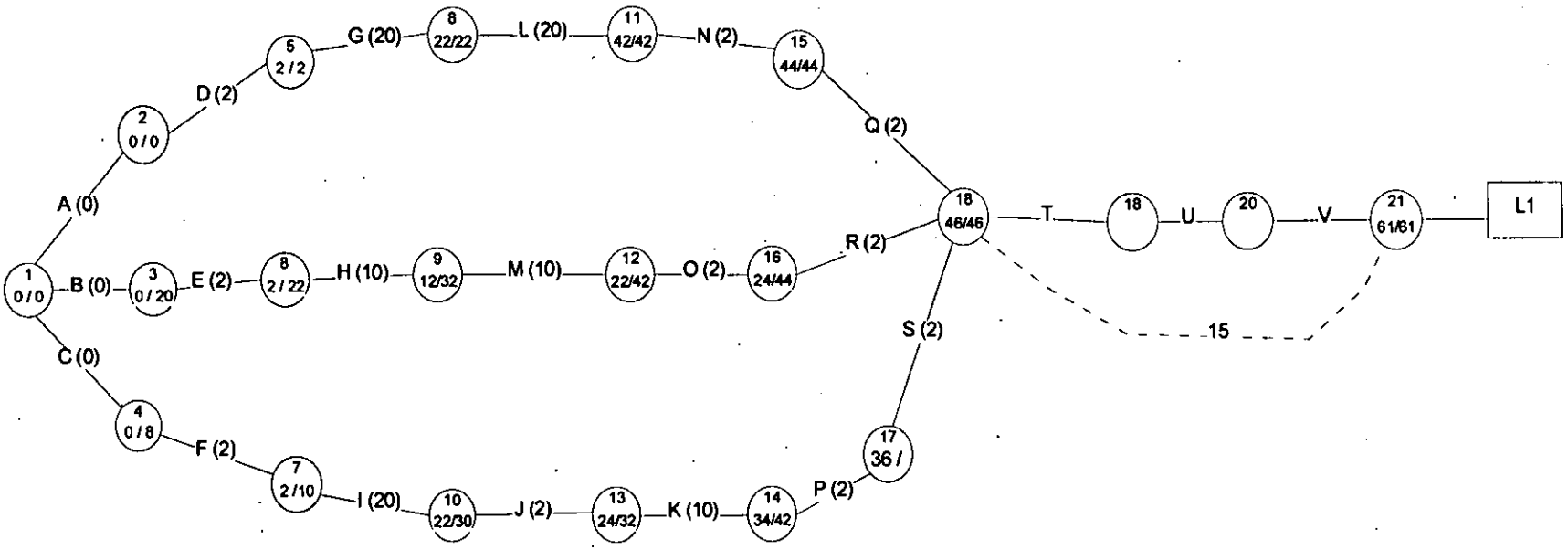


Figure E1 - Critical Path Analysis for catalogue production at Tony Stone Images

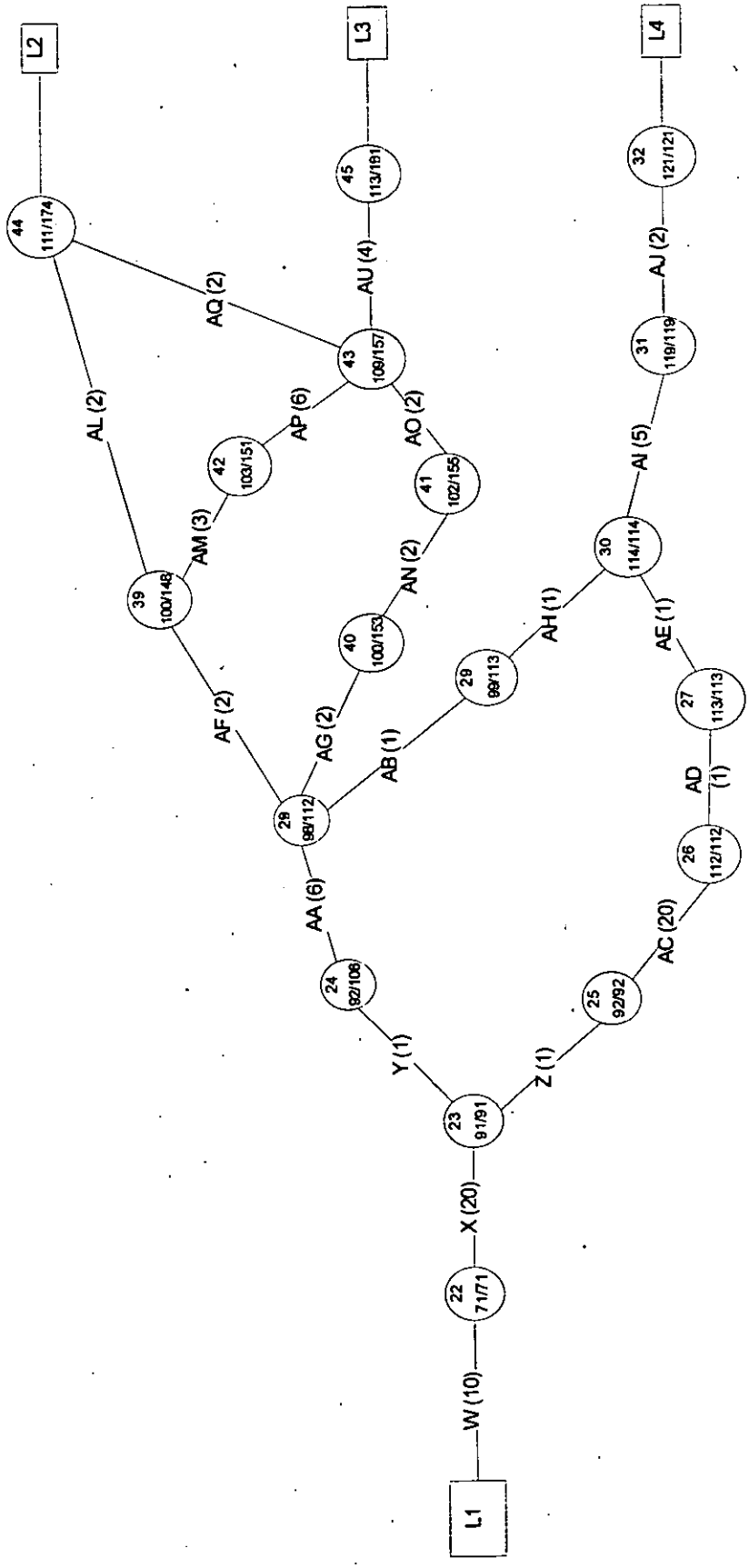


Figure E2 - Critical Path Analysis for catalogue production at Tony Stone Images (cont.)

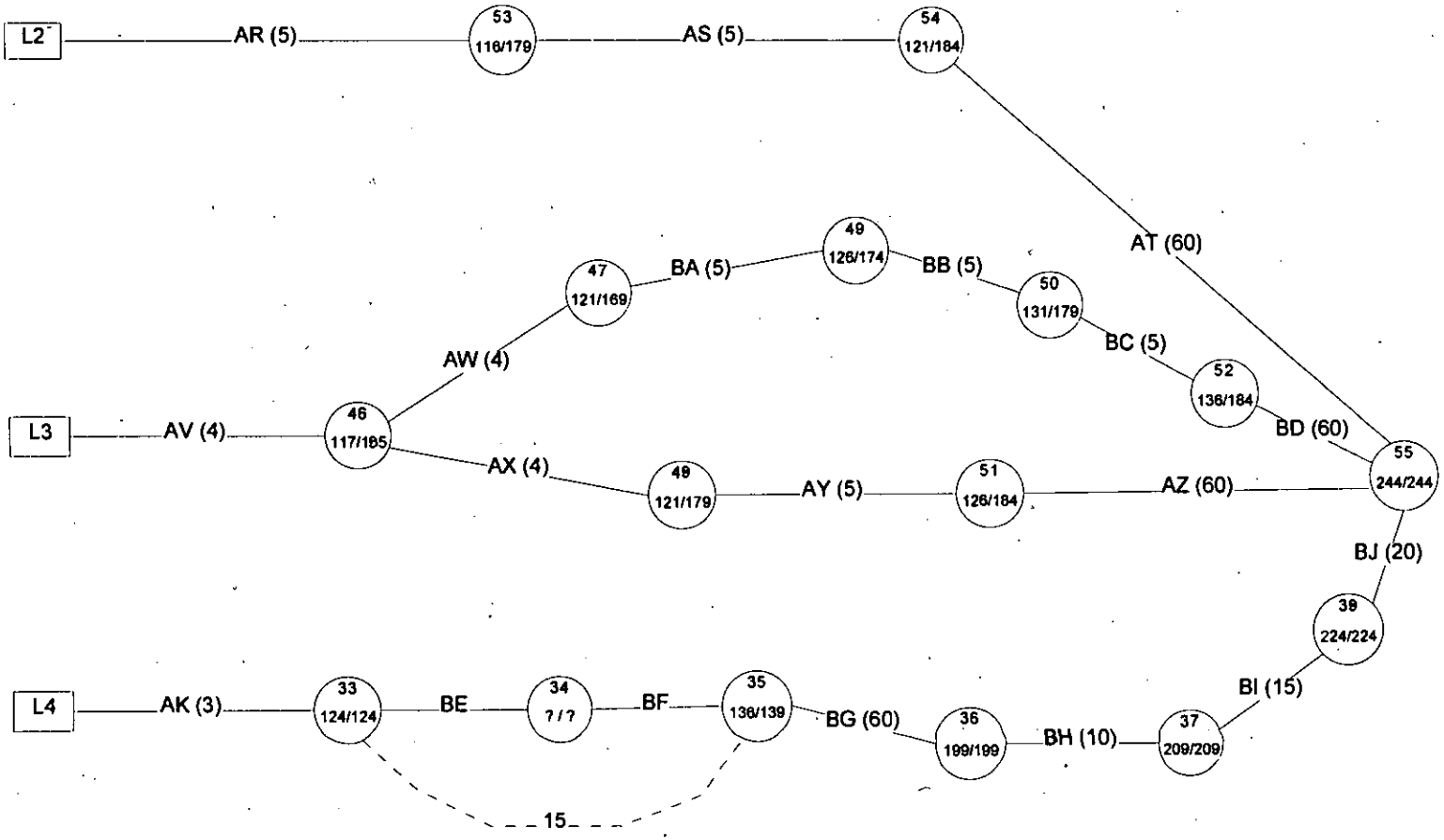


Figure E3 - Critical Path Analysis for catalogue production at Tony Stone Images (cont.)

Appendix F - Workflow System Sample Screens

The following pages show sample screens from the Creative and Image Classification modules of the Workflow system.

They are:

Figure F1 - The booking in screen for a photographer's submission.

Figure F2 - A sample editing list for the Creative department.

Figure F3 - A sample editing list for an individual editor.

Figure F4 - The screen for recording the results of editing a submission.

Figure F5 - A sample queue screen for barcoding and framing.

Figure F6 - A sample queue screen for sistering, numbering and captioning.

Figure F7 - A queue screen for images awaiting dupe selection.

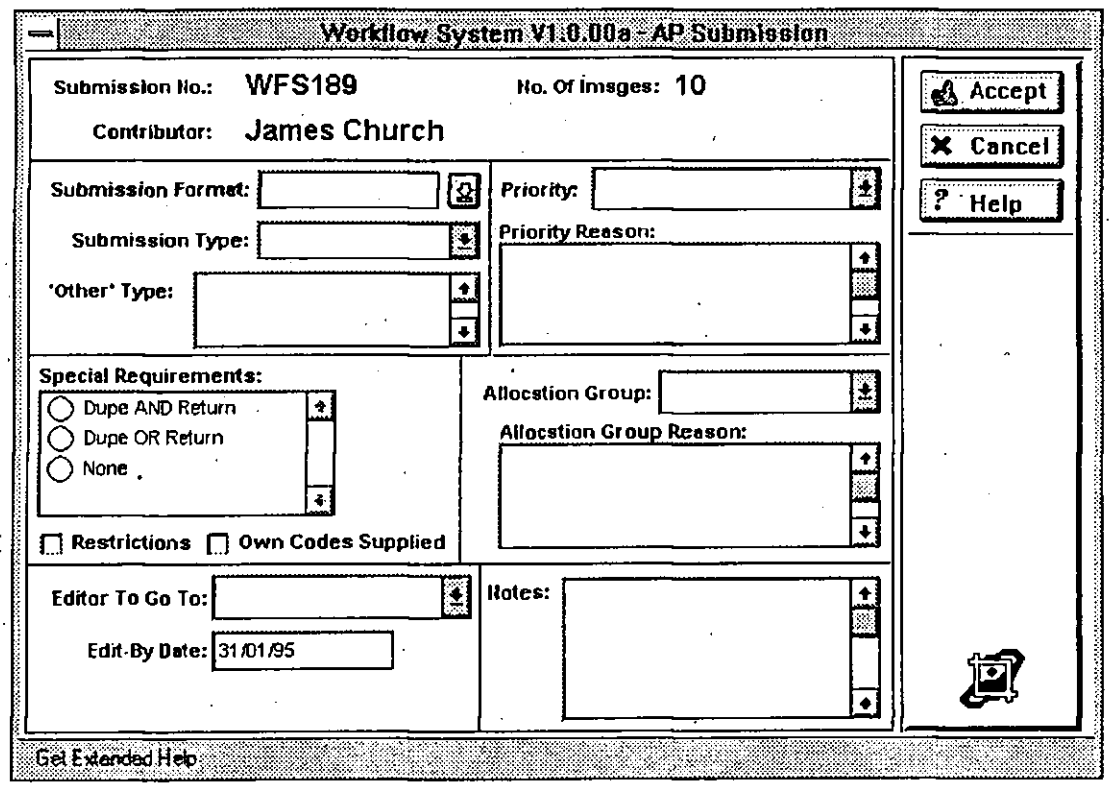


Figure F1 - The booking in screen for a photographer's submission.

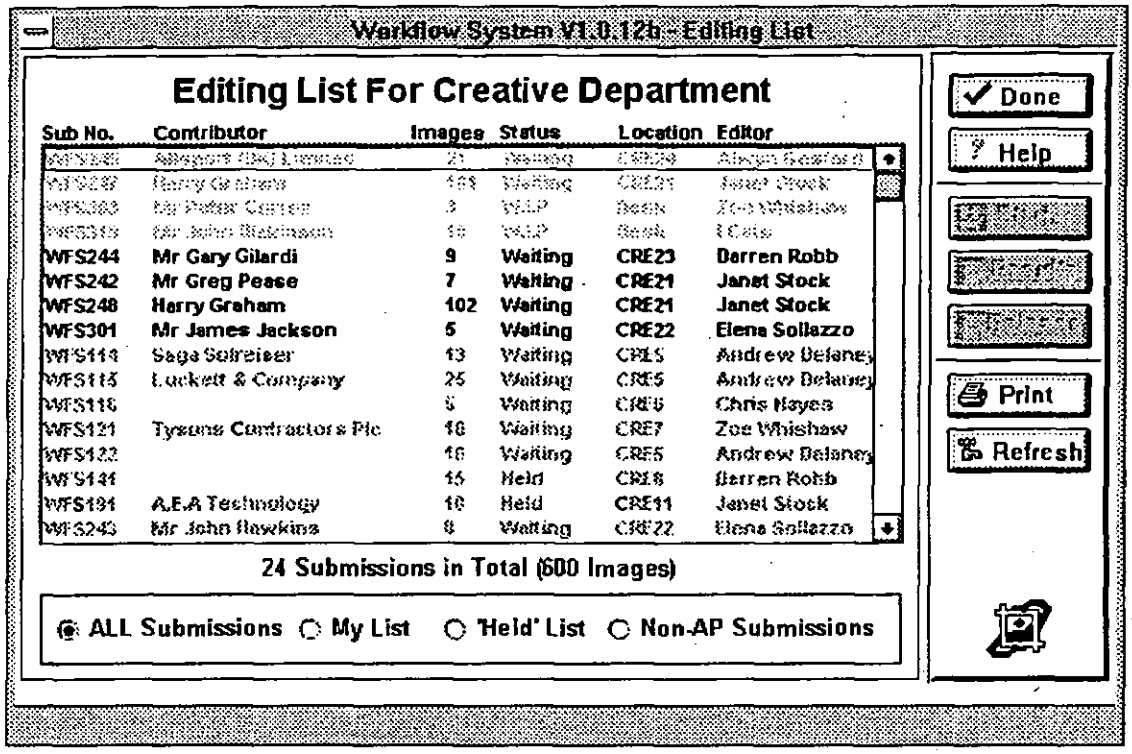


Figure F2 - A sample editing list for the Creative department

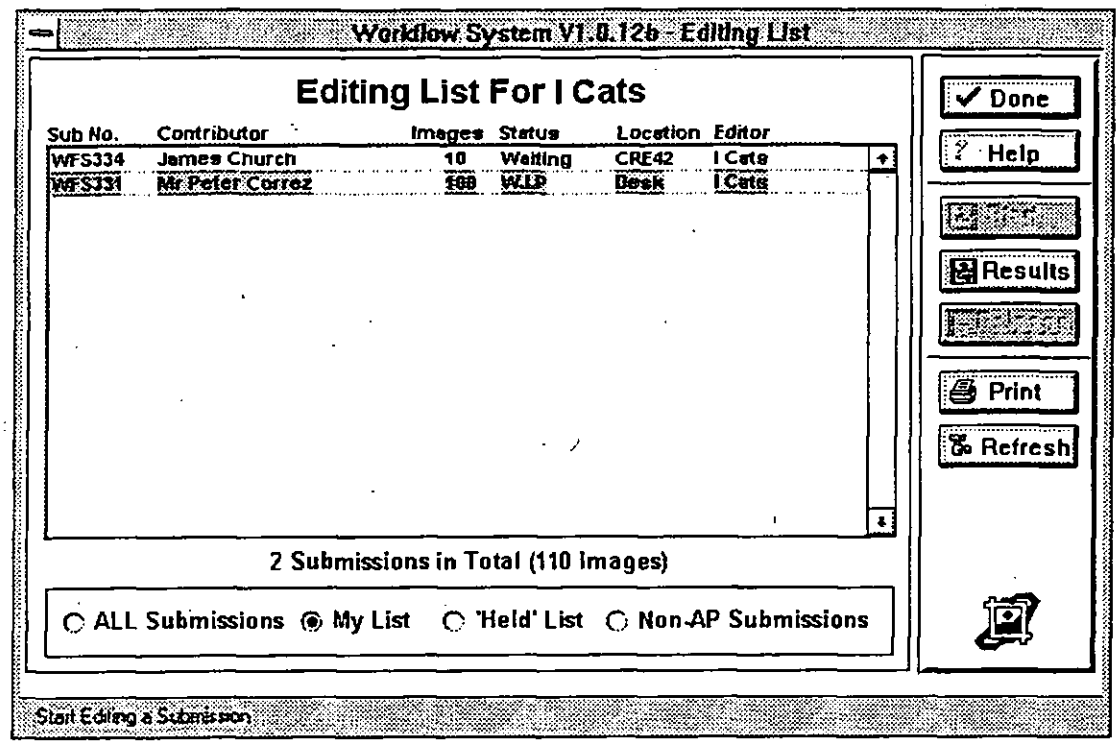


Figure F3 - A sample editing list for an individual editor.

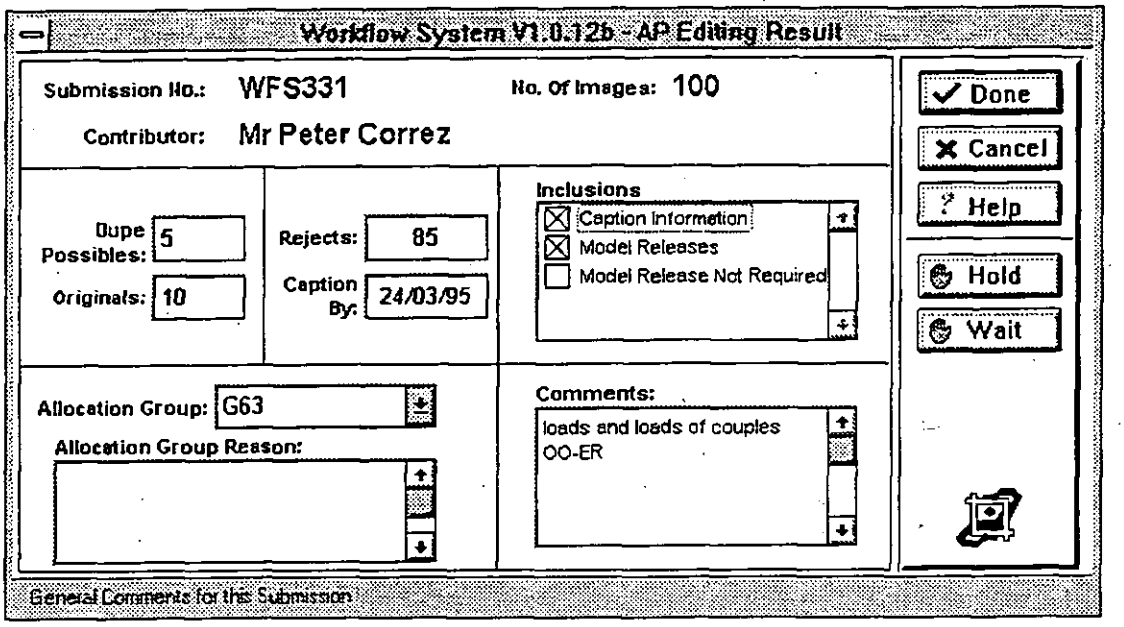


Figure F4 - The screen for recording the results of editing a submission.

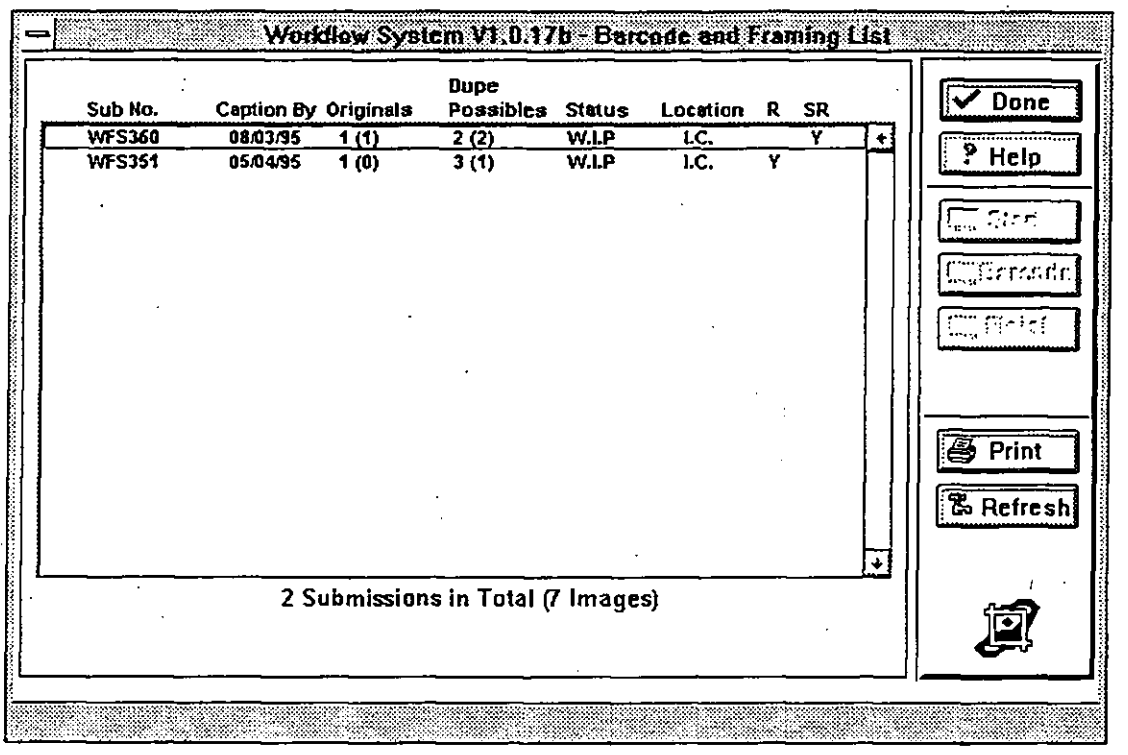


Figure F5 - A sample queue screen for barcoding and framing.

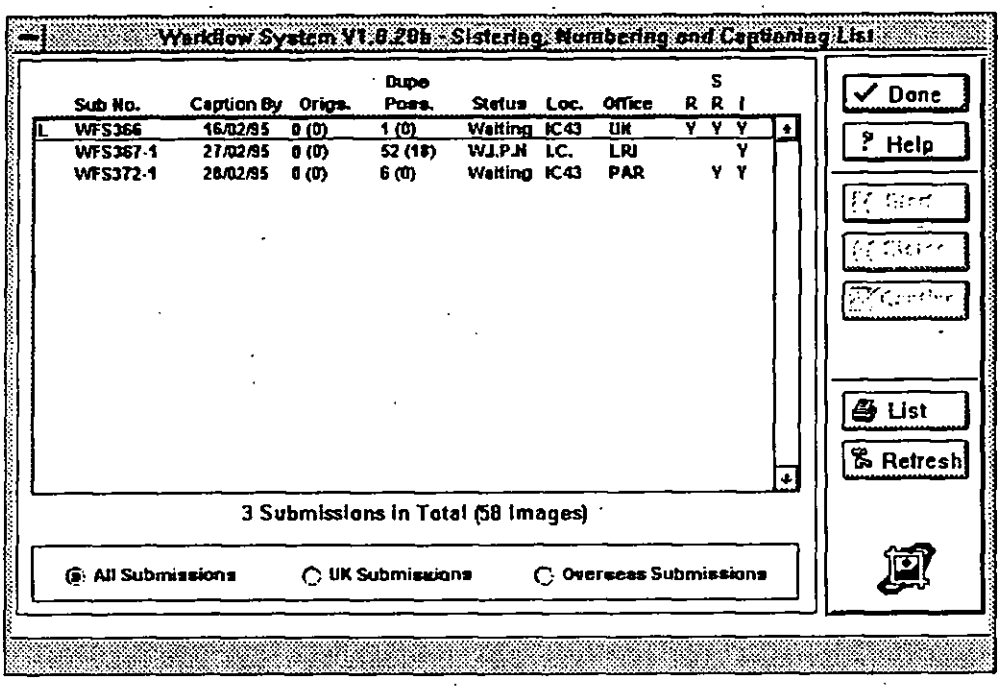


Figure F6 - A sample queue screen for sistering, numbering and captioning.

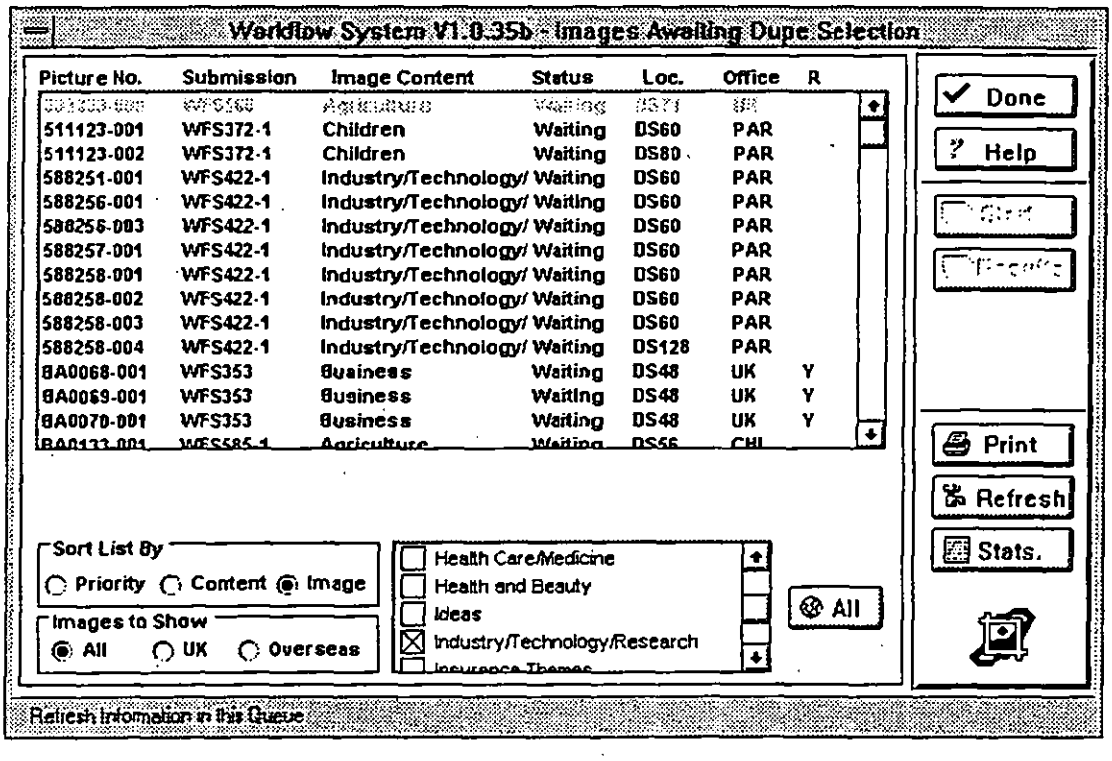


Figure F7 - A queue screen for images awaiting dupe selection.

Appendix G - Published Work

The following report is a paper published for the Middlesex University Conference MUCORT in 1995. It can also be found in the conference proceedings.

The Implementation of a Production Planning and Control System in a non-conventional Manufacturing Environment.

"Change is indeed everywhere - regardless of country, culture or organisation."

Rosabeth Moss Kanter (Kanter 1991)

This paper covers the work carried out for an industry based MPhil. The business is located in Camden Town in north west London and competes directly in the supply of stock photography images to the media and advertising.

The project was formed for a Teaching Company Scheme set up to run between Middlesex University and Tony Stone Images from September 1993 for two years. The Teaching Company Scheme is a joint funded venture between industry, an academic establishment and the government and is designed to improve academic and industrial relations by carrying out industry based improvement projects with university support.

The initial Scheme brief was

- To install a customised production planning and control system.

The criteria for success of achieving this objective are:

- To reduce product lead time from 16 weeks to 4 weeks by 1995.
- To reduce work in progress by 75%
- To increase production capacity by three times by 1996.

- To increase the frequency of catalogue production from 1 to 3 per year by the end of 1996.

The last two points have been achieved, not directly through the Teaching Company Scheme but by imposition from the board. The growth of the company has meant that various issues became a greater priority and so were implemented earlier.

The business was started by Tony Stone in 1962 with the idea to sell stock or 'off the shelf' photography to the greeting card, calendar and related markets. In 1969, the company was incorporated and started representing the work of other photographers. In the early 70s Tony Stone Images (TSI) moved into the advertising, design and travel markets. Today it is involved in the production and lease of photographic transparencies to various markets including advertising, editorial and multi-media. The company is continuing to expand at an exciting rate with a total of 20 overseas offices and agents selling stock images.

Continuous Improvement in the Production Process.

The first stages of the project were to fully understand the nature of the business and the production process. The production process is very arts based which makes the control and management of it different from conventional manufacturing in the following ways:

- There is only one bill of material
- No two product numbers are the same
- Raw materials stock control is based on marketing requirements
- The product lead time is not the same for every job
- The product lead time cannot be guaranteed

Market research is carried out both externally and internally from sales records about the type of images currently in demand by various clients. This

information is then fed to the Creative department who target the company's Associated Photographers to shoot the required images.

The production process is structured in the following way:

- A photographer submits a selection of work to the company (either on speculation or as targeted by Creative). The Creative department then edits the work against quality, subject and style criteria. It is then marked in terms of those images which are to be rejected and those which are good enough to become part of the library collection. Of those which are kept, one of two paths can be taken.

- The first path is that the picture is good enough to be part of the collection but does not warrant multiple copies being made - it is therefore filed as an 'original'

- The second path is where a picture is good enough to be part of the collection. It is deemed to be capable of multiple sales around the world so is put forward for duplication (of up to 300x) - it is therefore progressed as a 'dupe possible.'

- Rejected images are returned to the photographer. Both the originals and the dupe possibles go through the Image Classification department where they are serial numbered and have descriptive captions added.

- A second decision making process takes place at dupe selection, where the path for dupe possibles is determined. If an image requires enhancement then it will go through Electronic Imaging before going to the Darkrooms for duplication. If an image requires small changes such that the cameras can deal with, it goes directly to the darkrooms for duplication.

- After duplication, the film has to go off-site for processing and on return it is quality checked. The strips of processed film go to the Framing and Finishing

department. Outworkers are employed (so again work is progressed off-site) to mount, frame, sleeve and attach a bar-code and picture label to each individual image.

- On returning from the outworkers, the duplicate images are divided into their countries of destination for the overseas offices and agents, are packaged up with the correct paperwork and despatched. A quota of duplicate images also remain in London for sale in the UK.

The UK collection now holds approximately 250,000 different images (26,000 duped, 224,000 originals) and is being added to at the rate of 200 per week. On a worldwide scale, the number of originals held is approximately 2M.

Tony Stone Images also produces two catalogues per year with the policy that every image appearing in the catalogues will be available for sale in each of the offices and agents at the time of catalogue launch. This in itself creates a massive duplication programme, regardless of continuing to duplicate those images that were not selected for the catalogues.

In January 1994, job tracking forms were attached to 30 submissions to fully establish the length of time a submission takes to become images, and then to enter into the files as either originals or dupe possibles. By June of 1994, 13 tracking forms were returned with the following results.

Type of job	Number of tracking forms	Average days in the system	Number of working weeks
Images rejected after editing	8	19	4
Images filed as originals	3	45	9
Images filed as dupes	2	85	17

The problem with the job tracking forms is that once images were passed to the darkrooms, the forms were getting lost or forgotten in the job bags. The results

are therefore only accurate up to images leaving dupe selection. Two of the tracking forms reached the darkrooms in the following time.

Submission Number	Date booked in	Date booked to the Darkrooms	Time so far in the process
5562	17/01/94	25/03/94	10 weeks
5561	17/01/94	17/03/94	9 weeks

In the last month, two more tracking forms have been spotted part way through the process. So far, the following results are available.

Submission Number	Date booked in	Date booked to the Darkrooms	Time so far in the process
5809	28/02/94	06/04/95	57 weeks
5764	08/02/94	24/03/95	55 weeks

As the duping and framing and finishing part of the process can be measured due to resource availability and the fact that work is progressed in weekly batches, it is known that once images reach the darkrooms, the time to finish the work off and file it available for sale is 4 to 5 weeks.

From the two tables produced, the time for an image to be passed to the darkrooms can vary from 9 weeks to 57 weeks. The only reason for the time differences to be so great is the decision making process within the Dupe Selection area of the Creative department. Every image is different and so corresponds to a different set of criteria.

Usually, depending upon image priority, product lead time can take anywhere between four and six months. Unfortunately due to the scale of catalogue production there are some cases of images taking longer than a year to be progressed. These images are those which have been accepted to be part of the collection, but not included in the catalogue, so have a lower priority. TSI is now almost permanently in a state of catalogue production and so the images

required for the catalogues are progressed first, leaving those not required for the catalogues waiting until there is some production capacity available. This is becoming a serious problem and needs to be addressed.

Once images are in the files, they are available for sale and will be sent to a client as part of a selection. A fee is charged for a client selection. Once the client has confirmed that he / she wishes to use a certain image the rights to use the image in a territory / market for a fixed period is granted. The charges made for an image are determined by how the image is to be used. For example, an image used on the front page of a magazine will cost a client more than for an image used inside the magazine as a small frame to break up some text. Once the image has been used, it is returned to the library, is reframed and filed to be used again.

The reframing process also creates problems. The fact that a reframe exists indicates that a sale has been made. The problem is that the same resource is required for framing new images as that which is used for reframes. It is intended to adjust the levels of resources to cope with the requirement.
A flowchart of the full production process was produced in the first three months of the programme, followed by a period of six months in the effort to carry out some process improvements.

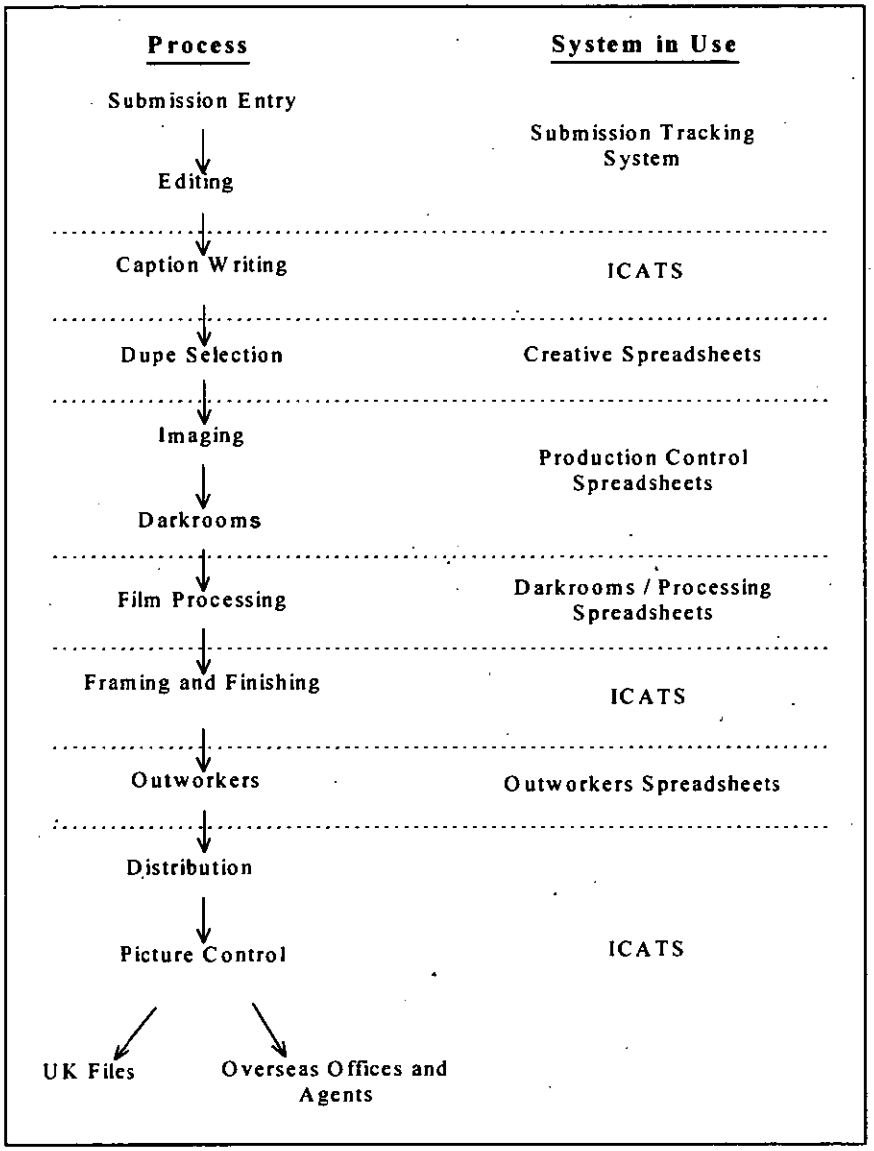
- Investigation into the automation of the framing and finishing process
- Changing the caption checking procedure
- The introduction of basic manufacturing techniques (Only being able to run as fast as your slowest machine - The Goal)

Production Planning and Control

The production planning and control system at TSI has become known as the Workflow system and is planned to be implemented in stages, the first stage went live on 22nd May. It has been written in-house specifically for the business

as it was felt that 'off the shelf' manufacturing software would be difficult to implement and run due to the nature of the business.

The following figure shows the range of systems in use and reinforces the need for one continuous tracking system.



In January 1994, the ICATS system was implemented (Integrated Computers At Tony Stone). This system mainly controls the sale of images to clients and in order to make sales transactions more efficient and the information about particular images more accessible, images had to be more accurately

numbered and captioned. ICATS therefore only covered those areas in production that gave sales the information they required.

Since the sales transactions had become more efficient, the lack of information within production became more and more apparent. In order to track work through the production process and into the files, the workflow system needed to be an extension of the ICATS database / system.

The main concern for the workflow system is its ability to track submissions and images through the system so that it is known where everything is, how long it's been there and what it's next stage in the process is. Submission tracking is the first implementation stage of the Workflow system and it will eventually replace the many smaller systems and spreadsheets which have been set up over time to control the flow of production.

The current system set-up has the following problems.

- The only connection between any of the systems running in production is a weekly download from ICATS to the submission tracking system and the darkrooms system.

- Reporting from the submissions tracking system and the darkrooms system is often inaccurate.

- The areas which use spreadsheets suffer from the errors inherent in extensive re-keying, cutting and pasting of data across departments.

- The information held on the spreadsheets is not always up to date and the process of getting it that way is very time consuming.

- Images are moved around the company without any controls on recording the transaction.

Education and training will be as equally important as the implementation of the first section of the workflow system. The correct movement of images around the process and the importance of recording transactions will be addressed.

A certain amount of process re-engineering has also taken place to compliment the implementation of the system. This has largely involved the introduction of a bin system for the flow of the images between departments. Each bin is clearly labelled which is reflected by the location indicator in the system. This way submissions and individual images are easily located through a system query.

The next phase for the Workflow system is to implement image tracking into the production side of the business, thus controlling work which is passing through the duping process, framing, finishing, distribution and storage. Currently, this is planned for the second half of this year.

Learning

Many things have been learned throughout this project, the most significant being:

- Systems implementations are very different in practice compared to in theory.

- A system implementation is very difficult in a business which has to operate on a daily basis and whose main interest is making money.

- It was difficult to keep the profile of the project high due to the daily issues with running the company.

- The amount of time to programme the system was underestimated due to constant changes to the specification being made.

- Manufacturing theory and technology cannot be imposed on company's or individuals.

- The change and acceptance of different ways of working takes a very long time to become natural to the company, is very time consuming for the change agent and it is often very difficult to maintain motivation.

- The largest unknown about any change project is the people - it is impossible to say how and when individuals will react favourably and unfavourably to the work which is trying to be done.

- It is possible to implement a control system in an arts based company provided the limitations of the system can be fully understood. The best way is to start simple, include all of the basics required and then there is room for development if necessary.

Conclusions

The project has been very beneficial both to the company and the author. The company has learned a lot about basic manufacturing techniques and how they can be adapted and implemented to control a largely arts based process. The author has learned a lot about systems projects and the importance of planning the activities which need to be carried out.

Change takes a lot of time, effort and patience; is even more difficult in a growing, changing environment; but rewards are forthcoming.

"There is always another hill to climb, competitors are always hot on your heels and the ability to change must become a way of life."

Sir John Harvey-Jones (Harvey-Jones 1992)

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